

NATIONALGEOGRAPHIC.COM/MAGAZINE AUGUST 2006

**INSIDE: ARMY ANTS**

# NATIONAL GEOGRAPHIC

**No End in Sight**

# Killer Hurricanes

**New Orleans: Home No More** 42

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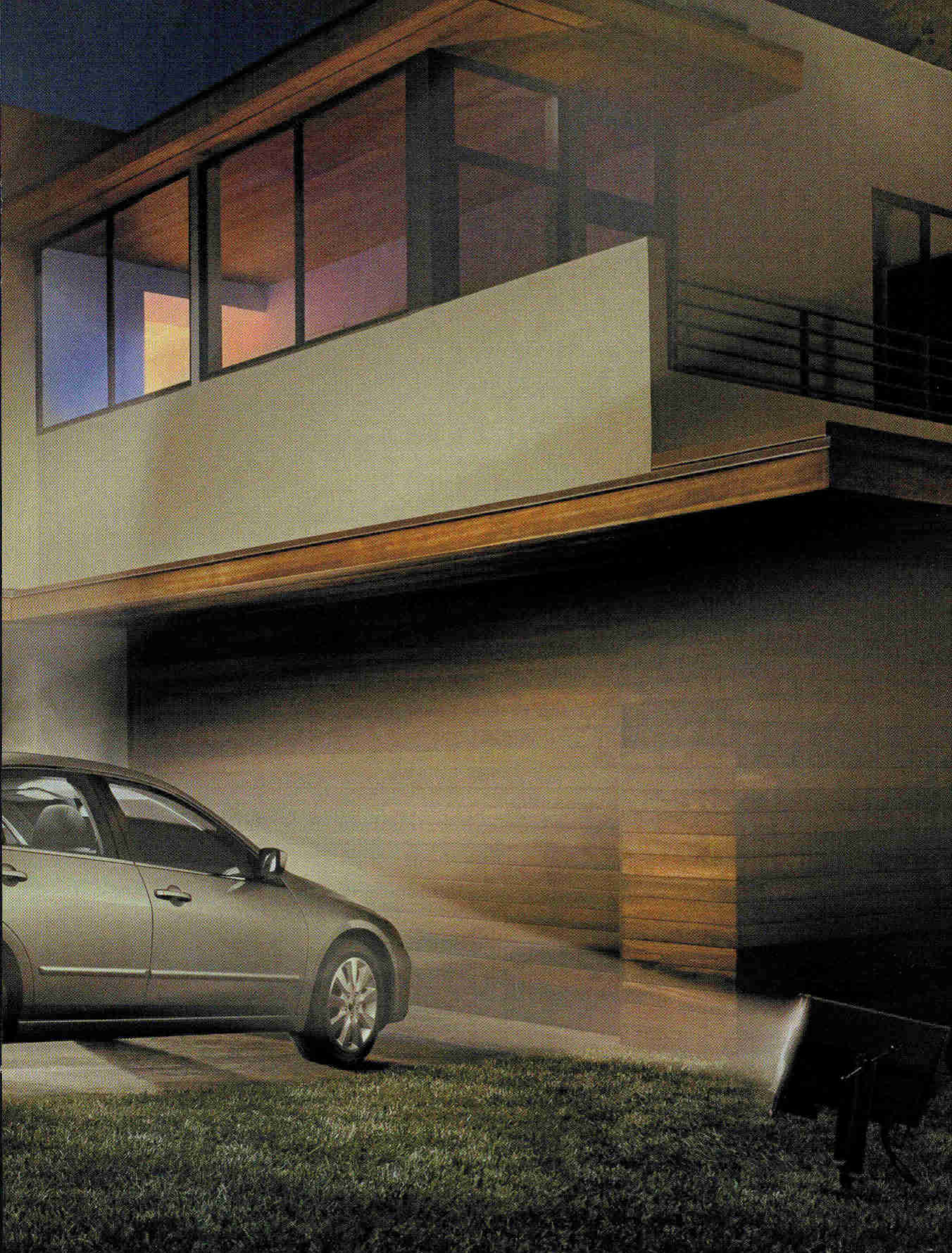




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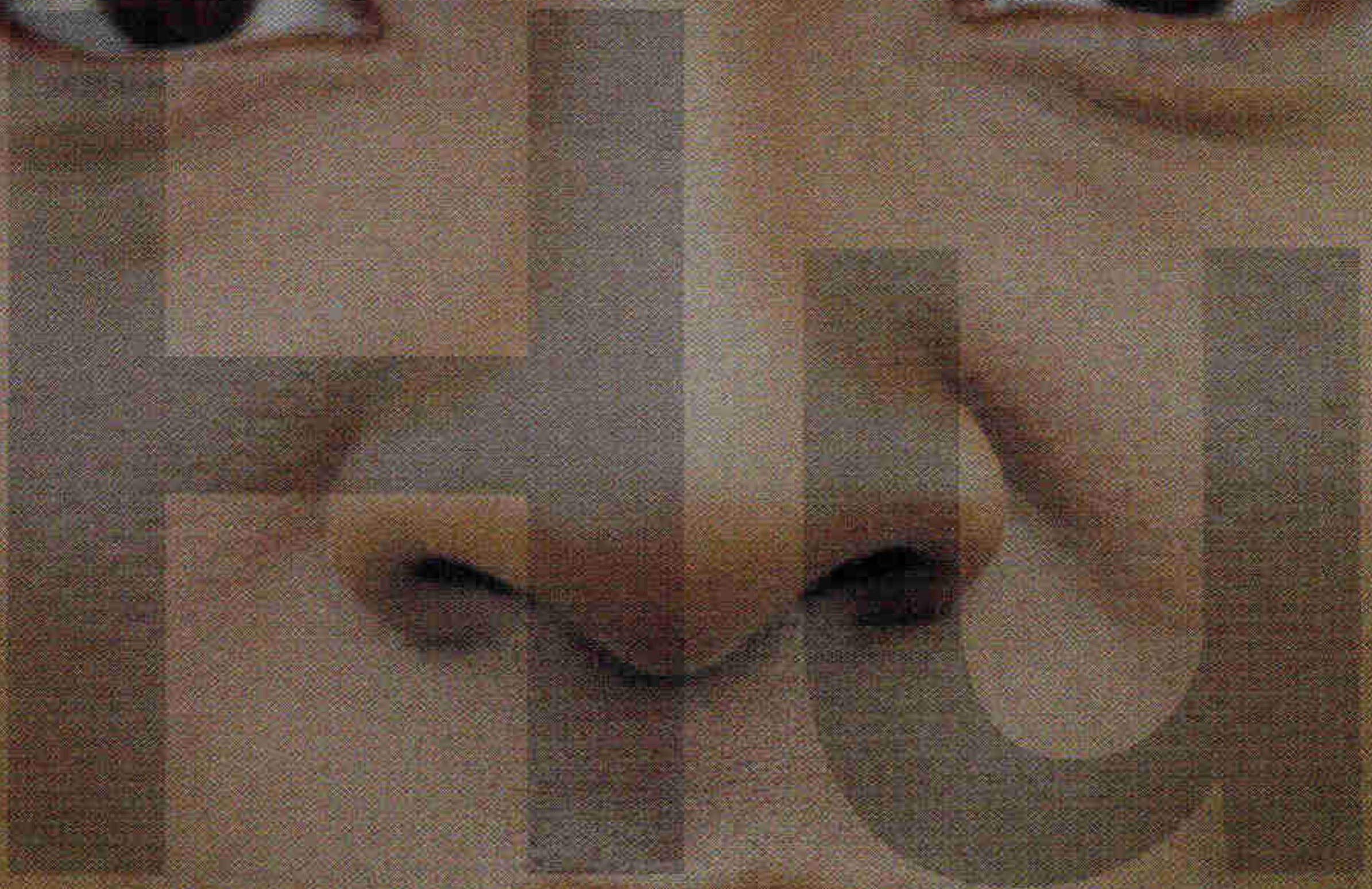


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7E-09



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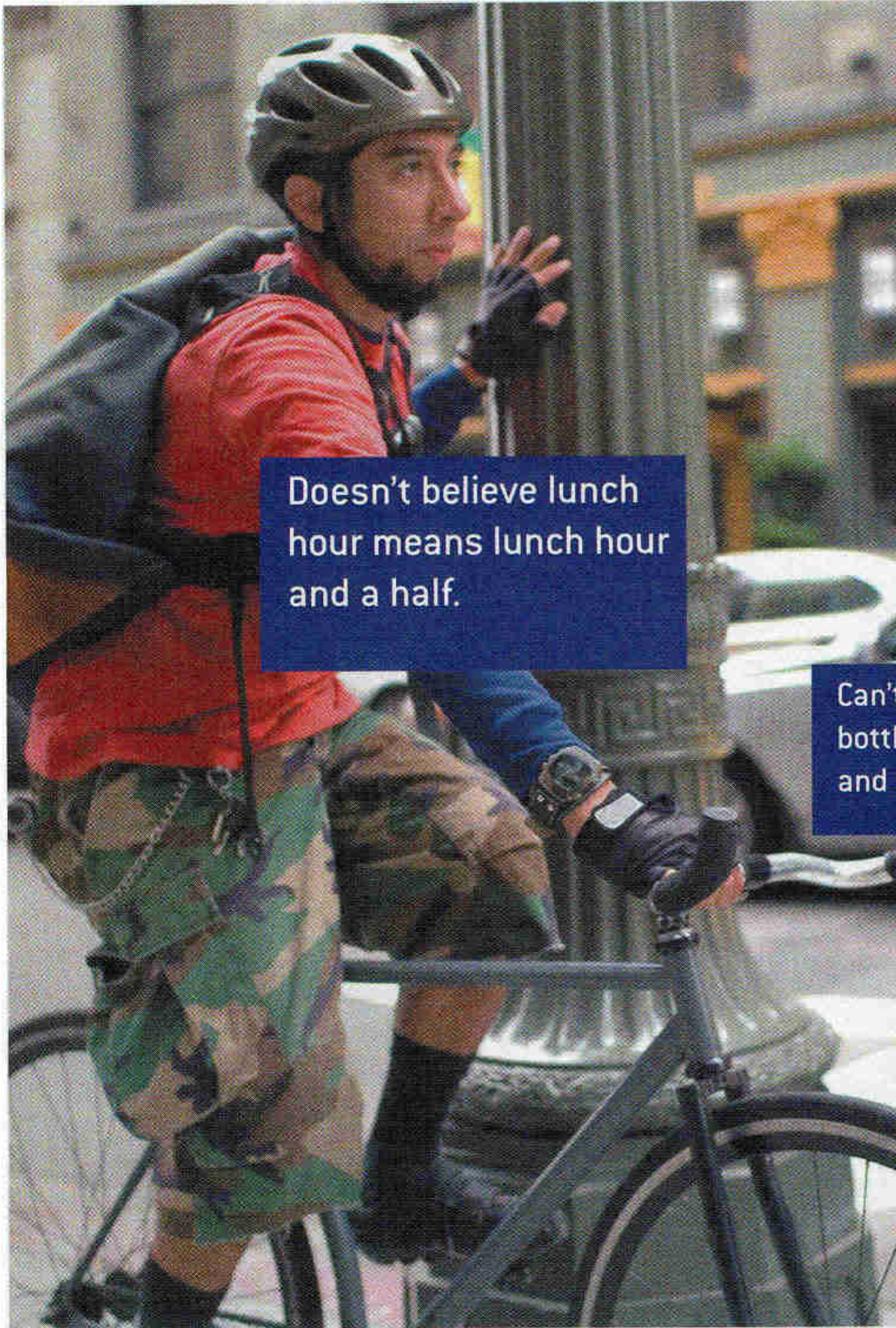
world changes. Suddenly, the power of chemistry is put to work solving human

problems. Whether it's putting food on every table or a glass of clean water

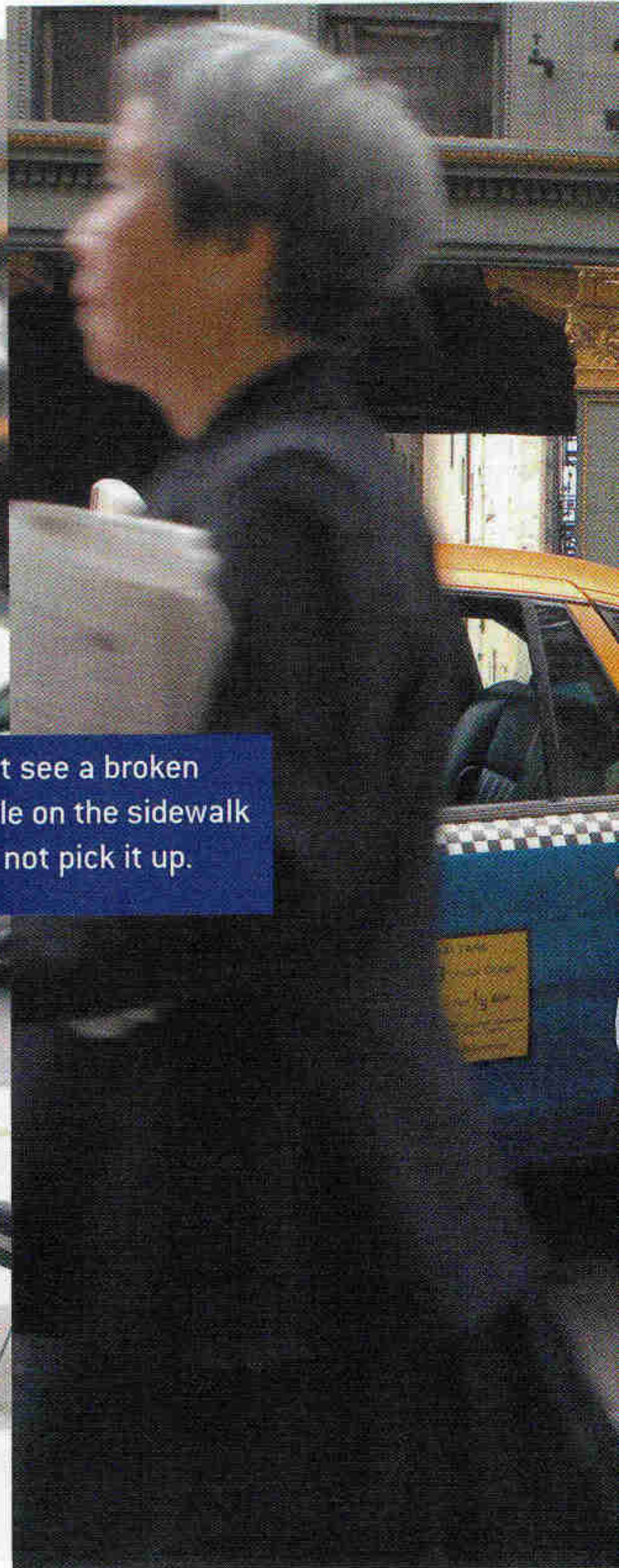


in every hand, the powerful catalyst for change is elemental. The Human Element.





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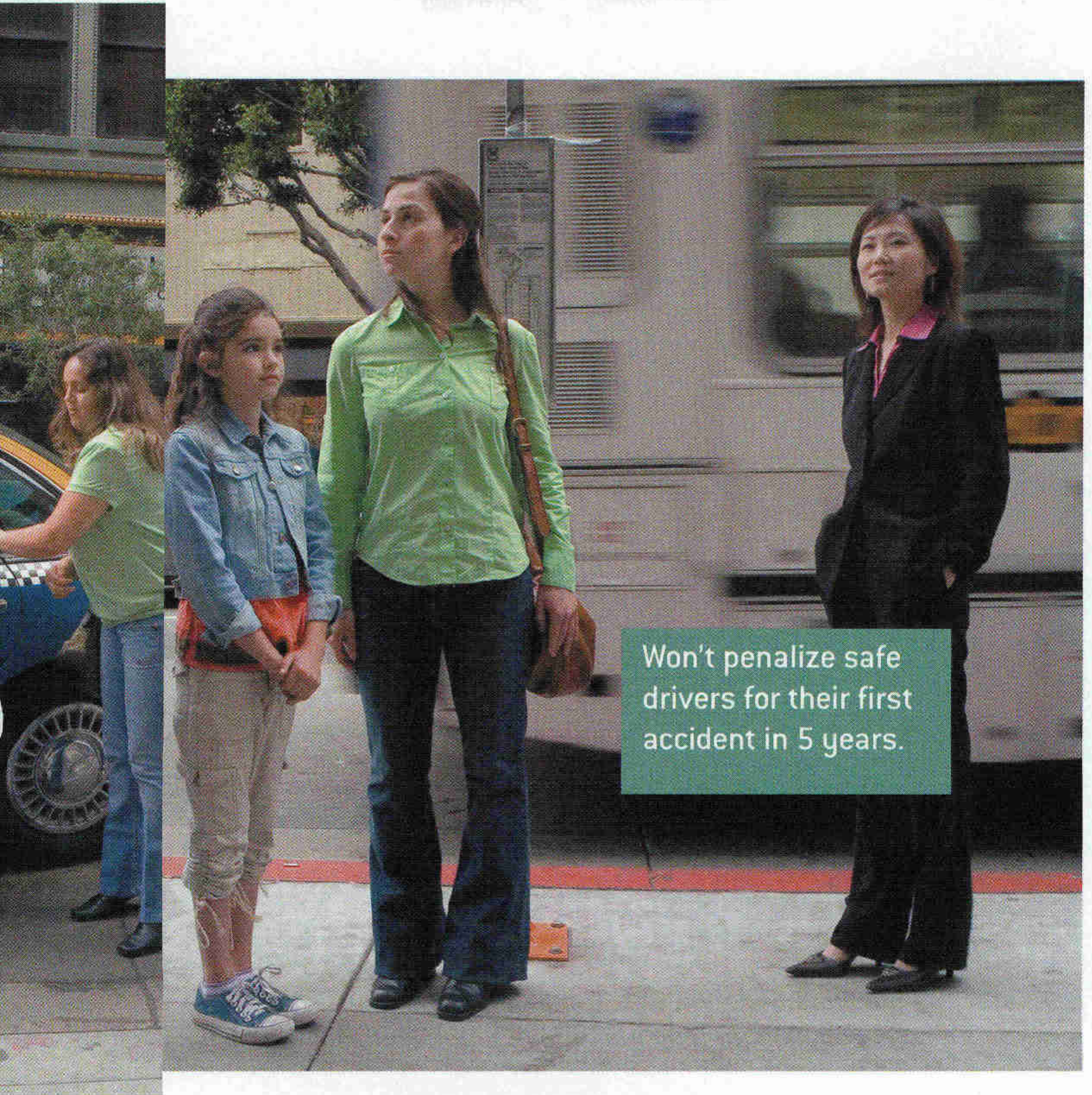


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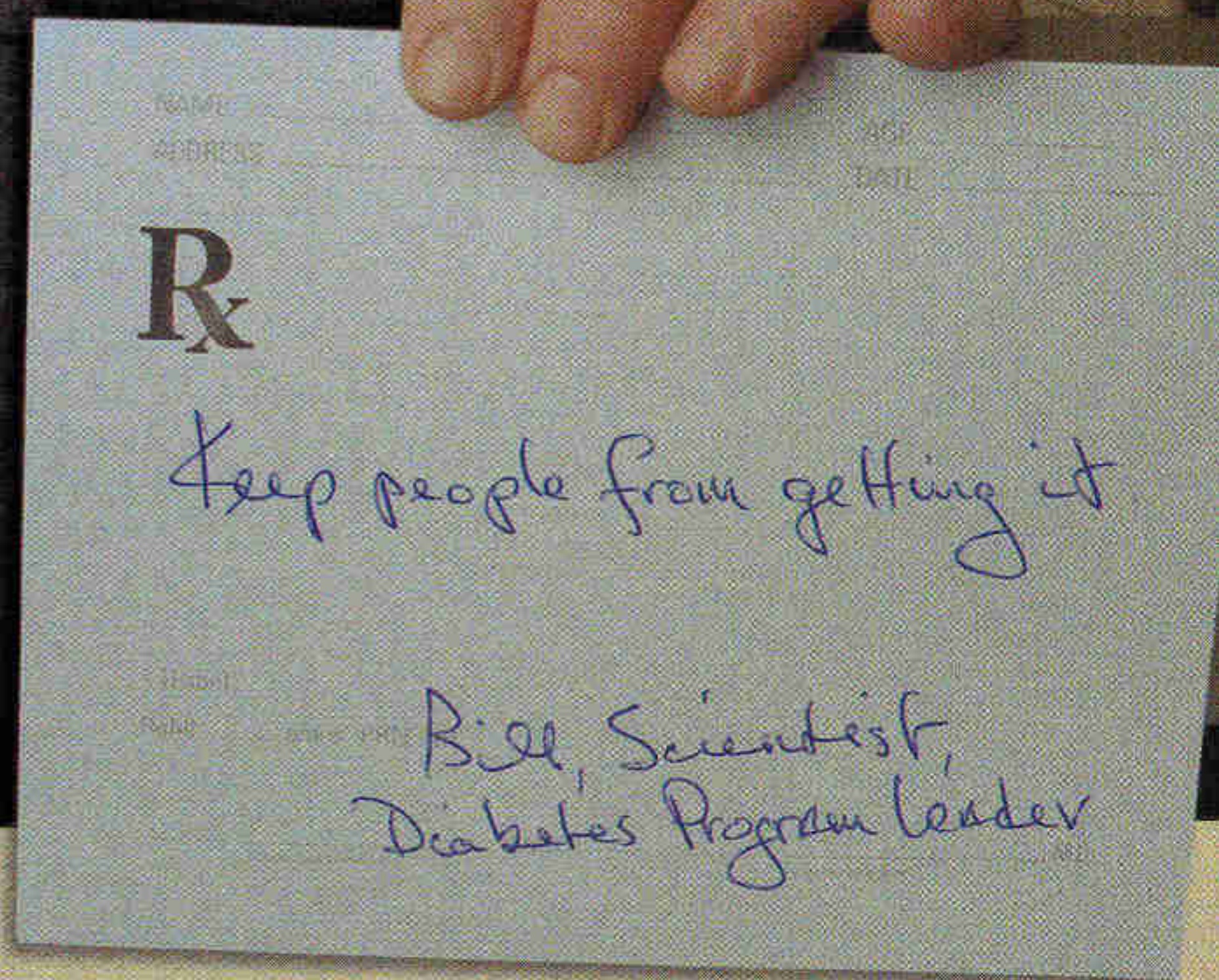
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# NATIONAL GEOGRAPHIC

AUGUST 2006 • VOL. 210 • NO. 2

## Swarm Raiders

An army ant straddles the remains of an insect victim's exoskeleton as she carries it home to her colony in the forests of Panama.



MARK W. MOFFETT

## Features

- New Orleans Portfolio** 42 Last year's Gulf Coast hurricanes upended landscapes and lives. Much will be rebuilt, but much is gone forever.  
**PHOTOGRAPHS BY DAVID BURNETT** **ESSAY BY ERNEST J. GAINES**
- Super Storms** 66 Scientists are urgently trying to forecast the next killer hurricanes.  
**BY THOMAS HAYDEN**
- Ghost World Guardian** 78 For 50 years rancher Waldo Wilcox guarded a Utah canyon full of artifacts from the ancient Fremont culture. Now the secret's out.  
**BY DAVID ROBERTS** **PHOTOGRAPHS BY IRA BLOCK**
- Smoky Mountain Seasons** 90 The quiet splendor and patchwork history of the popular national park offer lessons in how humanity can coexist with nature.  
**BY ADAM GOODHEART** **PHOTOGRAPHS BY MICHAEL MELFORD**
- A Geographic Life** 108 Some people dream of exotic adventures with NATIONAL GEOGRAPHIC. Thomas J. Abercrombie lived that dream.  
**BY DON BELT**
- Where Currents Collide** 120 In wild tides surging through the straits of Vancouver Island off British Columbia, marine life grows up strong and beautiful.  
**TEXT AND PHOTOGRAPHS BY PAUL NICKLEN**
- Army Ants on the March** 136 At the pinnacle of social cooperation, army ants overwhelm their prey through their sheer force of numbers.  
**ESSAY BY EDWARD O. WILSON**  
**TEXT AND PHOTOGRAPHS BY MARK W. MOFFETT**

**COVER** Hurricane Katrina approaches New Orleans on August 28, 2005.

**IMAGE: RAY STERNER AND STEVE BABIN, JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY; NOAA**

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**In the Wake of Hurricanes**

"I remember finding out that my grandpa was alive." New Orleans teenagers record Katrina's aftermath in words and photos. Photographer David Burnett finds the Gulf Coast still in turmoil.

**Ants: Up Close and Personal**

Biologist-photographer Mark Moffett offers himself as live bait while narrating this video of army ant behavior.

**Live WildCam: Grizzlies**

The world's largest gathering of brown bears stakes out a remote corner of the Alaska Peninsula each summer to gorge on salmon. You can experience this remarkable event live via webcam at [ngm.com/wildcamgrizzlies](http://ngm.com/wildcamgrizzlies).

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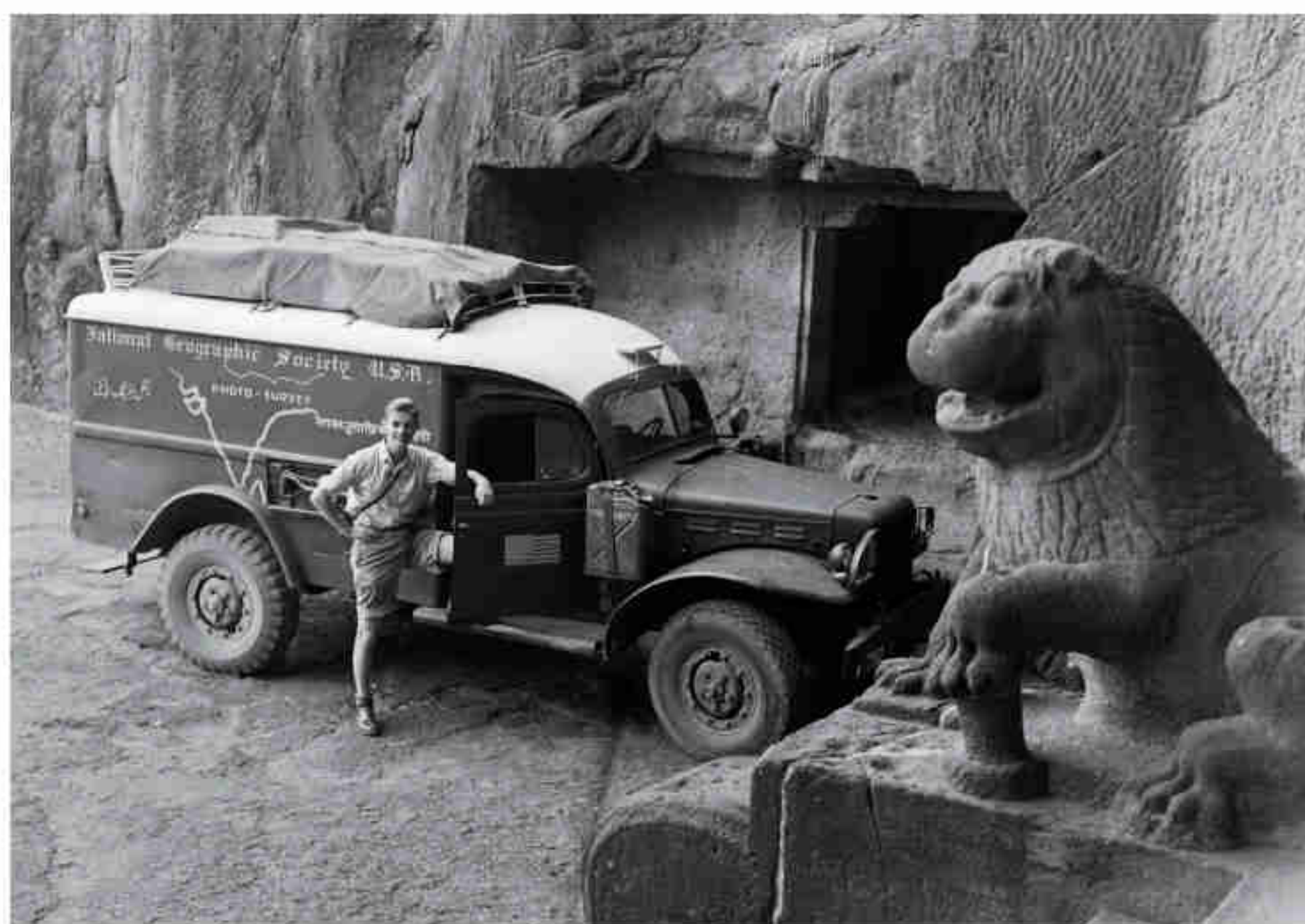
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**This magazine** has lost two dear friends within the past few months—both photographers and larger-than-life legends. You'll read about one of them, Tom Abercrombie, in this month's issue. Volkmar Wentzel, whose career spanned 48 years, died as this issue was going to press. You'll learn about Kurt, as he was called, in Photo Journal in next month's issue; in the meantime, I'd like to tell you how his work influenced me.

As a child growing up in a small town in Oregon, I spent Saturdays with my grandparents. They had shelves of old magazines,



Kurt Wentzel visited India's Ellora caves for a May 1953 GEOGRAPHIC story.

and I passed many afternoons absorbed in back issues of NATIONAL GEOGRAPHIC. Even today, I can summon the images, particularly those by Kurt Wentzel. There was the picture of a princess borne on a palanquin to her wedding in Jodhpur, the turbaned Rajput with his luxuriant beard, and the ruins of a temple near Islamabad. But nothing fired my imagination more than the image of a surplus army ambulance Kurt had outfitted as a rolling dark-room. Kurt explored 40,000 miles of Indian subcontinent in that vehicle, and to understand its impact on me, you need to know that I never left the West Coast until I was 18; a visit to my aunt and uncle in San Diego was my idea of exotic travel. I don't know at what point during my afternoon voyages through the magazine that the thought occurred to me: I can do this, too. I do know the image of that ambulance helped put me on the path of my life's work and passion. Kurt Wentzel's photographs opened a door to the realm of possibility.

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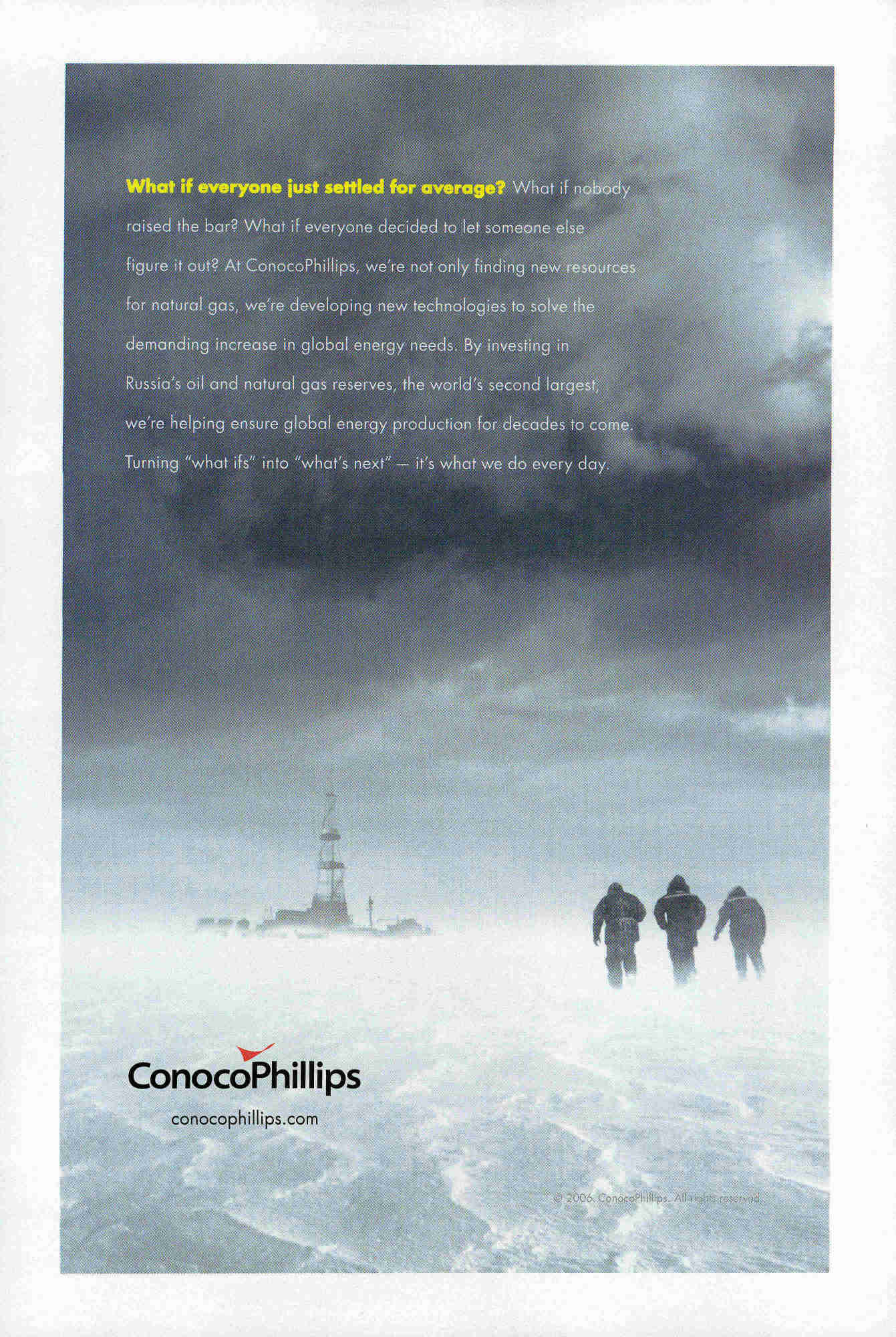
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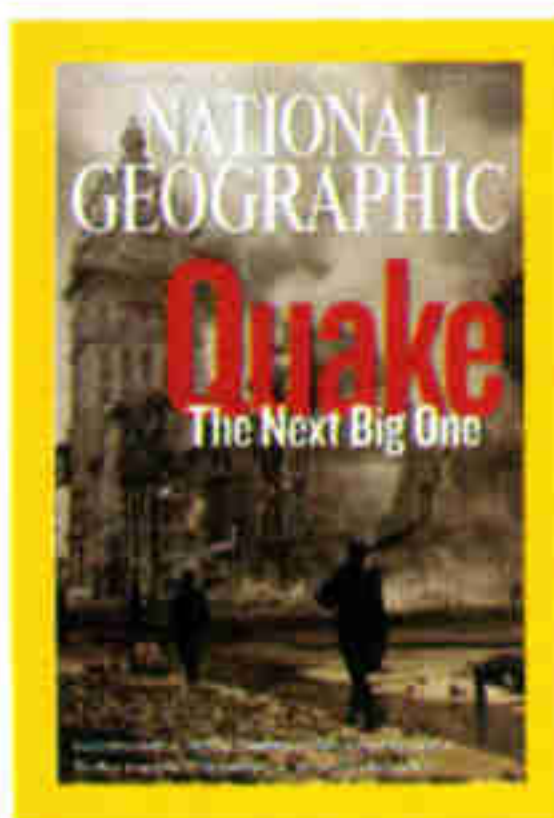
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# LETTERS



**April 2006** Many readers wrote in about “Nuclear Power.” Opinions on the subject were mixed, but our online poll was decisive: At press time, more than 70 percent of respondents felt the benefits of nuclear energy outweighed its costs. Other readers this month debated power of a different sort—that of Venezuela’s President Hugo Chávez.

➤ Voice opinions about August stories at [ngm.com](http://ngm.com).

## Nuclear Power

Apparently we can build nuclear reactors that are perfectly safe and would involve no eventual expensive decommissioning. All we need now are perfect safeguards against human laziness, stupidity, or malevolence.

**RALPH A. LEWIN**  
La Jolla, California

By almost any measure, the peaceful use of nuclear energy

has been highly successful for more than 50 years, except for two events—Chernobyl and Three Mile Island. Based on sustained efforts primarily by utility companies, the Institute of Nuclear Power Operations, the Electric Power Research Institute, and individuals dedicated to this technology, the operation of existing facilities is and will be acceptably safe, effective, cost-efficient, and reliable.

Yet due almost exclusively to uninformed and misguided decisions by policymakers and a public wary of any complex technology, the pursuit of new design, construction, and implementation of advanced nuclear facilities in the U.S. has been halted for more than 25 years.

**GLENN HUDSON**  
Tuscumbia, Alabama

I think your article on nuclear energy is biased. Nuclear energy is attractive for the shortsighted future. You point out that it is a cash cow, and it produces a large amount of power with very little pollution. But are the shortsighted gains worth the long-term consequences? Like waste for thousands of years?

**JOE LORENZO**  
Clearfield, Utah



76% of Americans plan on a more active lifestyle during retirement.



In the picture on pages 54-5, a young boy is cutting the grass with a gasoline-powered lawn mower within sight of Three Mile Island. The boy is wearing nothing but shorts; no safety glasses, no shoes, no trousers, no long-sleeved shirt, and no hat. It is more likely that the boy will be injured due to improper safety guidance than any potential injury from the nuclear power plant in the background.

**CARL FEDAKO**  
Bloomsburg, Pennsylvania

### Inside Chernobyl

Your Chernobyl article was well done and quite accurate, as was the nuclear rebirth article. But to combine them in the same issue effectively paints a picture of doom and gloom, and, as usual, casts a negative light on the

safety and performance record of electricity-producing commercial nuclear plants in the U.S.

**MICHAEL W. SCRIMSHER**  
Burbank Heights, Washington

Chernobyl's "deadly footprint" is dwarfed by the catastrophic consequences for those living downwind from the Aral Sea. This inland sea became filled with chemical and agricultural wastes prior to the breakup of the former Soviet Union. When its rivers were diverted, its shores receded, and prevailing winds dispersed residual salts contaminated with noxious pollutants. Millions in the region suffer chronic health problems, high infant mortality rates, and disproportionate birth defects.

**DONALD E. PIBURN**  
Kaaawa, Hawaii

### The Next Big One

I am a California-registered geologist. I live within ten miles of two major active faults, and I've mapped a few dozen others. I'm both amused and exasperated by continuing chatter about the Next Big One. How about all those "little" ones, all in southern California, namely Santa Barbara in 1925, Long Beach

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# LETTERS

in 1933, San Fernando in 1971, and Northridge in 1994, where damage was estimated at 20 billion dollars. The preoccupation with the San Andreas Fault, with a few thoughts tossed at the Hayward and Calaveras Faults, is ridiculous.

**ROBERT H. PASCHALL**  
Bishop, California

The New Madrid Fault Zone, an area that runs along Arkansas, Tennessee, and Missouri, was only mentioned on the insert map. According to the University of Arkansas at Little Rock Center for Earthquake Education and Technology Transfer, the New Madrid zone has historically been the site of some of the largest earthquakes in North America. In 1811 and 1812, four catastrophic earthquakes, with magnitude estimates of 8.0, occurred during a three-month period. At the time, the population density in these areas was minimal. Not so in 2006. A quake there now with a similar magnitude could result in devastating loss of life.

**ELIZABETH COCKRELL LOEB**  
Forrest City, Arkansas

## The New Venezuela

I was disappointed by your article on Hugo Chávez. While he may deserve criticism, let us try to keep some perspective. Yes, he makes long broadcasts on the state-run television network, but he doesn't interfere with the private networks, which overwhelmingly oppose him. Yes, he has a lot of power, but he was elected in a landslide. You paint Chávez as a dictator, criticizing his "squandering" of oil money to help feed and

educate his people. Would it be better for him to give away public resources to corporations for private profit, as is favored by our politicians?

**STEVE SCHNAAR**  
Santa Cruz, California

Your article leaves the impression that Venezuela's current government is a champion for the poor. During its tenure, unemployment has reached unprecedented levels, and even though the government tries to put on appearances of generosity, the programs reach a small minority. Worse yet, as the government boasts about its handouts, it does nothing to create jobs to truly help the nation prosper.

**MANUEL SCETTRI**  
Caracas, Venezuela

It's easy to judge President Hugo Chávez. He may be the wrong man for Venezuela. On the other hand, I can't recall any right-leaning president or dictator in modern Venezuelan history who made a difference or paid any attention to the poor of that country.

**ERNESTO WEISSON**  
San Antonio, Texas

## A Dry Red Season

You noted in the story how water from Lake Powell created green Little League fields and lush golf courses, but you did not note how many farms are irrigated nor how much power is generated. Granted there is always an environmental impact in damming rivers, but in comparison to the cost and hazards of nuclear power, also featured in the issue, hydroelectric power is a real plus.

**BERNARD H. MEYER**  
Newtown Square, Pennsylvania



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**Wild Yak** (*Bos grunniens*)

**Size:** Head and body length, up to 325 cm; shoulder height, up to 200 cm **Weight:** 305-820 kg  
**Habitat:** Alpine tundra and cold desert regions of the northern Tibetan plateau, at altitudes of 4,000-6,000 meters **Surviving number:** Estimated at fewer than 10,000 adults



Photographed by Milo Burcham

# WILDLIFE AS CANON SEES IT

Yak attack? More aggressive than its domesticated cousins, the wild yak is quick to charge when an intruder appears in its path. In most cases, though, it prefers the peaceful expedient of running away. Though it lives much of the year in the isolation of single-sex herds—protected from the elements by a marvelous skirt-like coat—the massive animal must travel great distances to forage for vegetation. These trips can be hazardous, bringing the yak into contact

with persistent poachers as well as livestock and the attendant risks of disease and interbreeding. As its habitat shrinks, more and greater dangers cross the wild yak's path every day.

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## LETTERS

Your Glen Canyon article and pictures brought tears to my eyes. In 1948, I went down the Colorado from Mexican Hat through Glen Canyon, so I will remember its beauty. All "river rats" will be vindicated when Lake Powell and the dam are gone. They should have listened to us back then. Glen Canyon was the greenest, most lush canyon on the entire river.

**BARBARA N. PAINTER**  
Laguna Beach, California

Your story was beautifully photographed and written with elegant prose. The story was clearly slanted, though. The author apparently gave no thought to sharing the experiences of the people who live and thrive here as it is, without complaint. We can supply water and energy and provide beauty and recreation to all those who visit.

**CARL ELLEARD**  
Page, Arizona

### Dragonfly Mating Game

I found the article to be way too anthropomorphic. The male dragonflies are guilty of "sexual harassment," exhibit "boorish behavior," and "hound" the females. My, my. Perhaps the louts should be called in for sensitivity training.

**RAMON DASCH**  
Austin, Texas

Fascinating article on the mating habits of dragonflies. I often sit in my canoe in a small lily pond. The spot is quiet, and many dragonflies flit among the reeds. Last summer, I noticed an odd phenomenon. When two dragonflies in tandem landed on a vertical rock, the bottom one repeatedly smashed against the rock until it freed itself from the hold of the top one! I now understand the female wanted to be free from the male that was protecting his sperm from being removed and replaced by a rival male.

**PHYLLIS ZELCER**  
Toronto, Ontario

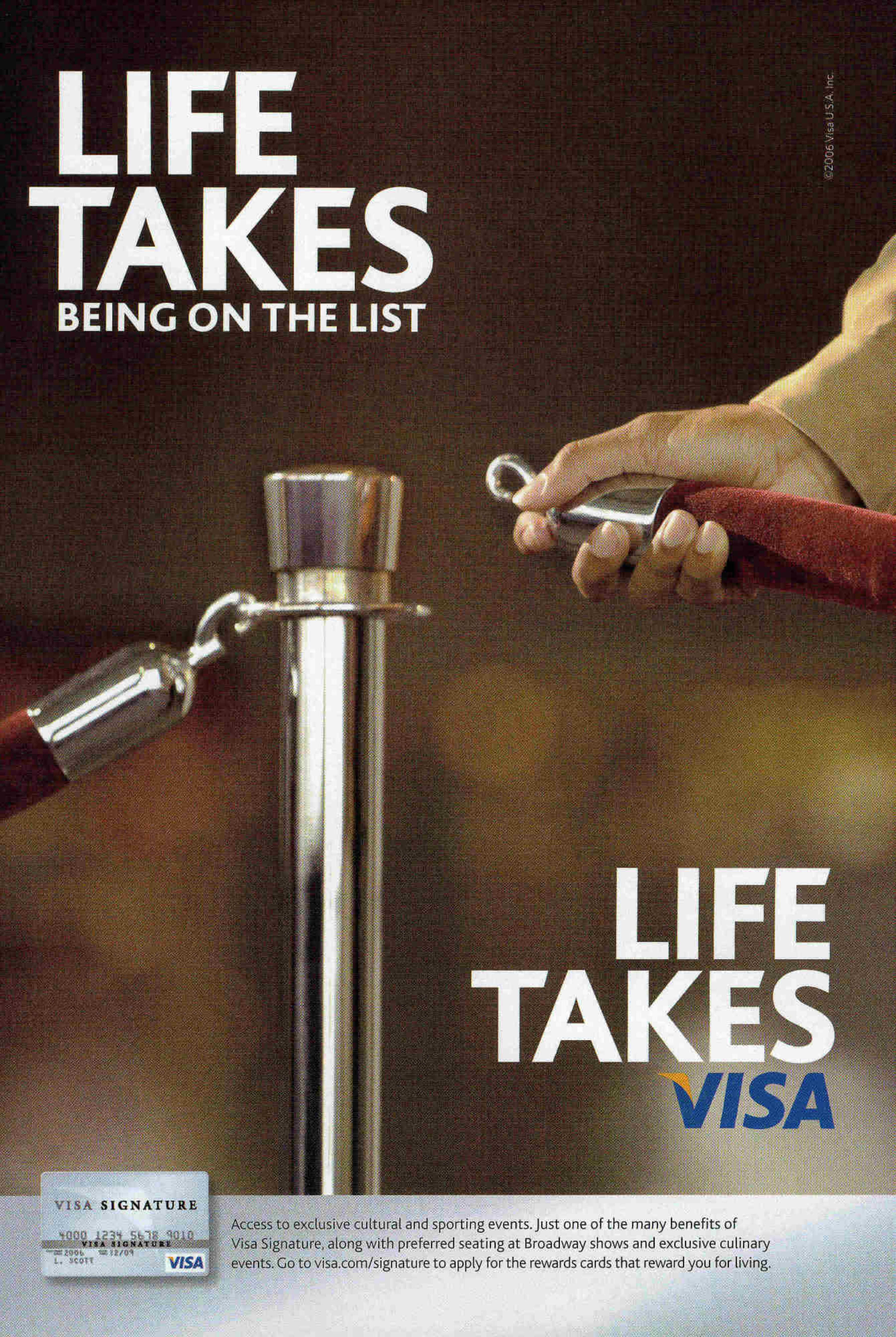


# LIFE TAKES

BEING ON THE LIST

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# LIFE TAKES



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## LETTERS

### ZIP USA:

#### San Francisco, California

Should it be surprising that a fondness for dogs is so great in the city named for St. Francis of Assisi? Perhaps an increasing appreciation for other species will be the salvation of our own.

TOM DANIEL  
San Francisco, California

As a 30-year resident of San Francisco, I must take exception to your article. Many of us are greatly disturbed by the thoughtless behavior of some dog owners with regard to our parks. Your article glamorizes them, which I fear will encourage more dogs off-leash in our crowded city. Much effort and money was spent to restore Crissy Field, a wetlands habitat in this zip code. Off-leash dogs are doing significant damage to this fragile area.

EUGENIE MAREK  
San Francisco, California

As it happens, I live with equanimity near the San Andreas Fault, but venture with great trepidation into the yuppified Marina district because those snarling dogs always object to my intruding on their turf. Sometimes in the middle of the night, I dream the Big One hits, and I'm the only human survivor, but then find myself pursued by ravenous packs of Marina district dogs. So now I've decided to add a large supply of dog repellent to my earthquake-survival kit.

WILLIAM BURKE  
San Francisco, California

### Science

I had to laugh after I read "Saliva's Saving Graces." As a mom and a teacher, I would always get upset when someone spit at someone. But on the other hand, when my kids were little, I never hesitated to use saliva for its cosmetic benefits: cleaning a smudge on a face or holding down that stubborn cowlick.

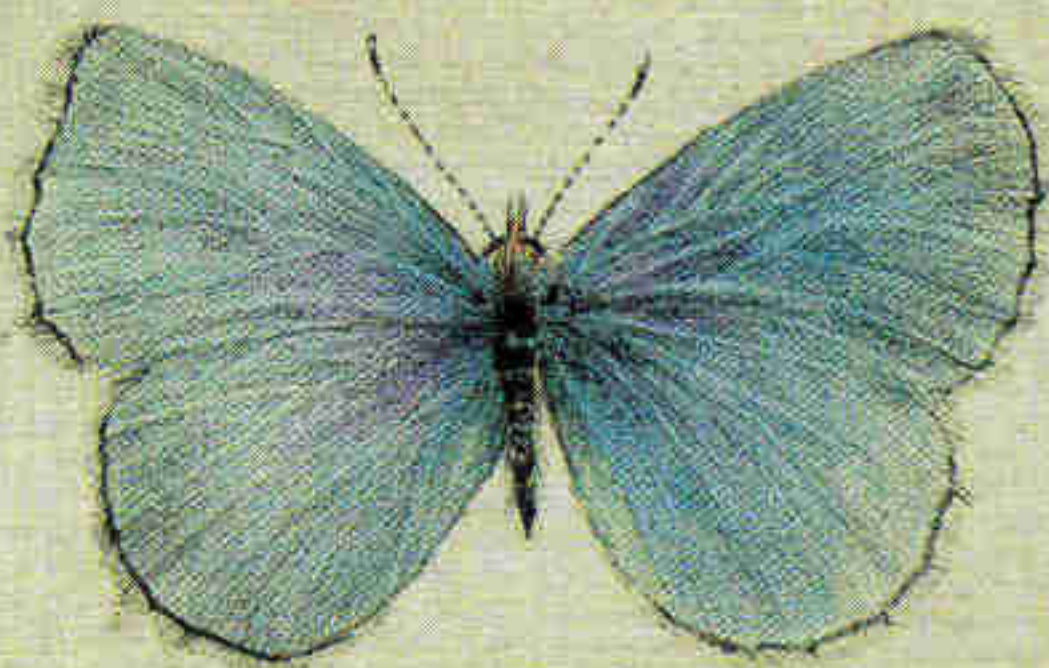
JOEANN HORNE  
Severna Park, Maryland



You know you've hit gold when the  
POLLYWOGS mingle with the ROLY-POLIES.



*Fig. 1 American Toad*



*Fig. 3 Spring Azure Butterfly*



*Fig. 5 Monarch Caterpillar*



*Fig. 7 Pollywogs*



*Fig. 2 Banded Gecko*



*Fig. 4 Ladybug*



*Fig. 6 Bullfrog*



*Fig. 8 Dragonfly*

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**Your Vacation** These pictures on the theme of “Where I Vacation” were selected from reader photos posted to the Your Shot website. Continue the conversation with our editors—and with NATIONAL GEOGRAPHIC readers—by submitting your own images on the new theme of “Around the Table.” Photographs selected will be published in the November 2006 issue. For guidelines, a submission form, and more information, go to [ngm.com/yourshot](http://ngm.com/yourshot).



**Wojciech Kocot** Kraków, Poland

**ABOVE** “The sea went wild,” says Wojciech Kocot of a Baltic crossing by the *Zawisza Czarny*—a ship owned by the Polish Boy and Girl Scouting Association. “I was in fear of losing the camera.” Kocot, a Kraków engineer and college professor, volunteered as an officer on the ship’s crew.

**RIGHT** Their father Frank caught “Team O’Brien” (Erin, from left, Kiernan, Kaitlyn, Egan, and Shealagh) in mid-leap during a trip to the Cayman Islands. “I could hear the kids running from the far side of the dock,” he says. “When they started to jump, I clicked.”



**Frank O’Brien** Easton, Connecticut

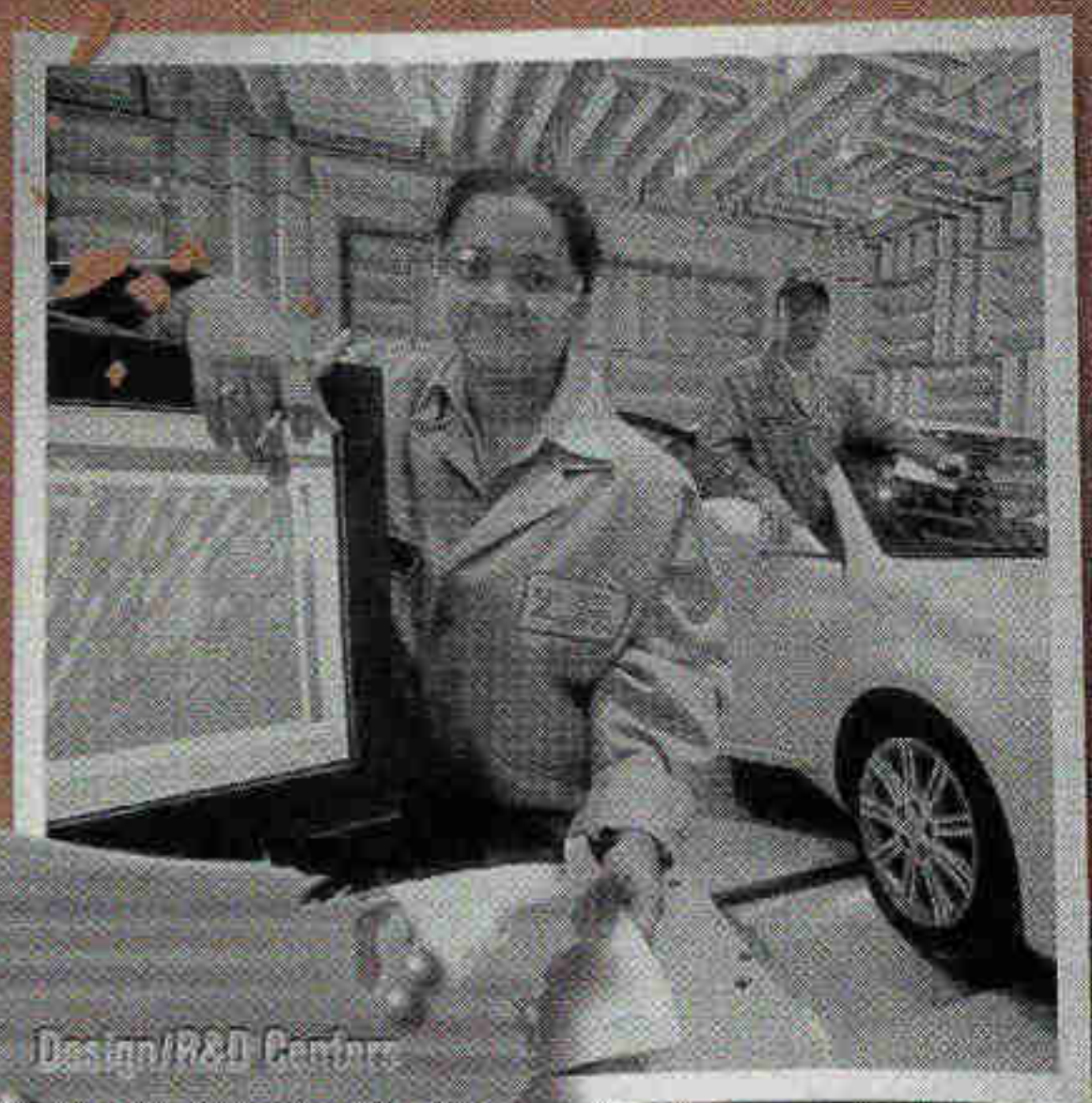




# Where we go when we go back to the drawing board.

**A**UTOMOTIVE DESIGN IS A FIELD FOR DREAMERS. Eventually, the best dreams become real. The project ends, a new one begins, and back to the drawing board the designers go. Our Caltex Design Research centers are full of such inspired dreamers. Together with the talented engineers at Toyota Technical Center (TTC), they bring these dreams to life.

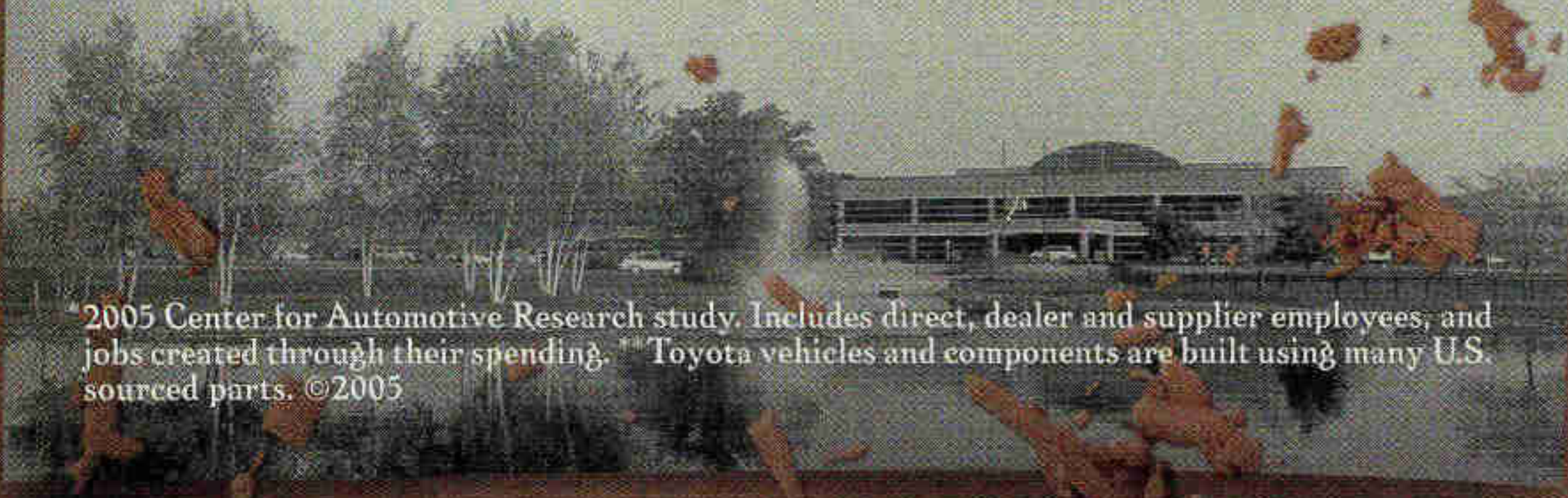
Yet Caltex and TTC may be two of Toyota's best kept secrets. By now, most people know that we build vehicles in the U.S.\*\* But what they might not know is just how much we rely on Caltex and TTC. They're an integral part of our investment in America, and we can't wait to see what they draw up next.



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\*2005 Center for Automotive Research study. Includes direct, dealer and supplier employees, and jobs created through their spending. \*\*Toyota vehicles and components are built using many U.S. sourced parts. ©2005





Brad Preston's place in Crawford is an old converted cotton gin.

**The President's Neighbors** I first visited Crawford, Texas, while traveling with President George W. Bush on assignment as a photographer for *Time* magazine. Back in 1999, when he was simply "candidate Bush," the Texas governor purchased roughly 1,600 acres in Crawford and named it Prairie Chapel Ranch. Now people call it the western White House. There are more than 1,400 miles between it and the more famous one in Washington, D.C. Perhaps that's why the President is so fond of it.

Heavily armed Secret Service agents and assertive press officials direct and control where photographers can go at the western White House—and when, and how. I'm known in those circles as "the guy who stepped on the grass." That's not a metaphor. Once, I accidentally put my foot down on a strip of the native buffalo grass at the Bush ranch and was severely scolded for doing so.

A tiny piece of Crawford always seems to peek out from behind the shoulders of correspondents as they report on the President's activities. But the town itself is rarely a focal point for coverage. On my visits there, when given the chance, I've strayed from the ranch's makeshift press room and set out to meet the people I call the President's neighbors.

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**Photo Gallery** View more of Musi's images at [ngm.com/0106/feature4](http://ngm.com/0106/feature4).



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Jayne Solomon of Plano, Texas, repositions a gift shop's cardboard cutout of the President after she and her friends posed with it for souvenir pictures. Crawford High School student Kendra Bowdoin enjoyed her job preparing the traditional Texas homecoming "mums" at the Country Basket, a local shop—no longer in business—that also rented videos and did dry cleaning.



**At 6'4", 220 pounds,  
Bob is a formidable man.  
But he's no match for something  
one millionth his size.**

**A CLOT.**

**Clots are the number one cause of heart attack and stroke, but you can help reduce your risk.**

**This is important information if you've been hospitalized with heart-related chest pain or a certain type of heart attack.**

That's because these conditions, known as Acute Coronary Syndrome – or ACS – are usually caused when blood platelets stick together and form clots that block blood flow to your heart. And if you've already had a clot, you're at an increased risk for a future heart attack or stroke.



**PLAVIX, in combination with aspirin, helps provide greater protection against a future heart attack or stroke than aspirin alone.**

PLAVIX, taken with aspirin, plays its own role in helping reduce your risk of heart attack and stroke. That's because, unlike your cholesterol and blood pressure medications, prescription PLAVIX works directly to help keep blood platelets from sticking together and forming clots.



**IMPORTANT INFORMATION:** If you have a stomach ulcer or other condition that causes bleeding, you shouldn't use PLAVIX. When taking PLAVIX alone or with some medicines including aspirin, the risk of bleeding may increase. To minimize this risk, talk to your doctor before taking aspirin or other medicines with PLAVIX. Additional rare but serious side effects could occur.

**Talk to your doctor today to learn more about PLAVIX.**

Or visit [www.plavix.com](http://www.plavix.com) or call 1.800.470.4017.

See important product information on the following pages.

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### INDICATIONS AND USAGE

PLAVIX (clopidogrel bisulfate) is indicated for the reduction of atherothrombotic events as follows:

#### • Recent MI, Recent Stroke or Established Peripheral Arterial Disease

For patients with a history of recent myocardial infarction (MI), recent stroke, or established peripheral arterial disease, PLAVIX has been shown to reduce the rate of a combined endpoint of new ischemic stroke (fatal or not), new MI (fatal or not), and other vascular death.

#### • Acute Coronary Syndrome

For patients with acute coronary syndrome (unstable angina/non-Q-wave MI) including patients who are to be managed medically and those who are to be managed with percutaneous coronary intervention (with or without stent) or CABG, PLAVIX has been shown to decrease the rate of a combined endpoint of cardiovascular death, MI, or stroke as well as the rate of a combined endpoint of cardiovascular death, MI, stroke, or refractory ischemia.

### CONTRAINDICATIONS

The use of PLAVIX is contraindicated in the following conditions:

- Hypersensitivity to the drug substance or any component of the product.
- Active pathological bleeding such as peptic ulcer or intracranial hemorrhage.

### WARNINGS

#### Thrombotic thrombocytopenic purpura (TTP):

TTP has been reported rarely following use of PLAVIX, sometimes after a short exposure (<2 weeks). TTP is a serious condition that can be fatal and requires urgent treatment including plasmapheresis (plasma exchange). It is characterized by thrombocytopenia, microangiopathic hemolytic anemia (schistocytes [fragmented RBCs] seen on peripheral smear), neurological findings, renal dysfunction, and fever. (See **ADVERSE REACTIONS**.)

### PRECAUTIONS

#### General

PLAVIX prolongs the bleeding time and therefore should be used with caution in patients who may be at risk of increased bleeding from trauma, surgery, or other pathological conditions (particularly gastrointestinal and intraocular). If a patient is to undergo elective surgery and an antiplatelet effect is not desired, PLAVIX should be discontinued 5 days prior to surgery.

Due to the risk of bleeding and undesirable hematological effects, blood cell count determination and/or other appropriate testing should be promptly considered, whenever such suspected clinical symptoms arise during the course of treatment (see **ADVERSE REACTIONS**).

In patients with recent TIA or stroke who are at high risk for recurrent ischemic events, the combination of aspirin and PLAVIX has not been shown to be more effective than PLAVIX alone, but the combination has been shown to increase major bleeding.

**GI Bleeding:** In CAPRIE, PLAVIX was associated with a rate of gastrointestinal bleeding of 2.0%, vs. 2.7% on aspirin. In CURE, the incidence of major gastrointestinal bleeding was 1.3% vs 0.7% (PLAVIX + aspirin vs. placebo + aspirin, respectively). PLAVIX should be used with caution in patients who have lesions with a propensity to bleed (such as ulcers). Drugs that might induce such lesions should be used with caution in patients taking PLAVIX.

**Use in Hepatically Impaired Patients:** Experience is limited in patients with severe hepatic disease, who may have bleeding diatheses. PLAVIX should be used with caution in this population.

**Use in Renally-impaired Patients:** Experience is limited in patients with severe renal impairment. PLAVIX should be used with caution in this population.

#### Information for Patients

Patients should be told it may take them longer than usual to stop bleeding, that they may bruise and/or bleed more easily when they take PLAVIX or PLAVIX combined with aspirin, and that they should report any unusual bleeding to their physician. Patients should inform physicians and dentists that they are taking PLAVIX and/or any other product known to affect bleeding before any surgery is scheduled and before any new drug is taken.

#### Drug Interactions

Study of specific drug interactions yielded the following results:

**Aspirin:** Aspirin did not modify the clopidogrel-mediated inhibition of ADP-induced platelet aggregation. Concomitant administration of 500 mg of aspirin twice a day for 1 day did not significantly increase the prolongation of bleeding time induced by PLAVIX. PLAVIX potentiated the effect of aspirin on collagen-induced platelet aggregation. PLAVIX and aspirin have been administered together for up to one year.

**Heparin:** In a study in healthy volunteers, PLAVIX did not necessitate modification of the heparin dose or alter the effect of heparin on coagulation. Co-administration of heparin had no effect on inhibition of platelet aggregation induced by PLAVIX.

**Nonsteroidal Anti-Inflammatory Drugs (NSAIDs):** In healthy volunteers receiving naproxen, concomitant administration of PLAVIX was associated with increased occult gastrointestinal blood loss. NSAIDs and PLAVIX should be coadministered with caution.

**Warfarin:** Because of the increased risk of bleeding, the concomitant administration of warfarin with PLAVIX should be undertaken with caution. (See **PRECAUTIONS—General**.)

**Other Concomitant Therapy:** No clinically significant pharmacodynamic interactions were observed when PLAVIX was coadministered with **atenolol**, **nifedipine**, or both atenolol and nifedipine. The pharmacodynamic activity of PLAVIX was also not significantly influenced by the coadministration of **phenobarbital**, **cimetidine** or **estrogen**.

The pharmacokinetics of **digoxin** or **theophylline** were not modified by the coadministration of PLAVIX (clopidogrel bisulfate).

At high concentrations *in vitro*, clopidogrel inhibits P<sub>450</sub> (2C9). Accordingly, PLAVIX may interfere with the metabolism of **phenytoin**, **tamoxifen**, **tolbutamide**, **warfarin**, **torsemide**, **fluvastatin**, and many **non-steroidal anti-inflammatory agents**, but there are no data with which to predict the magnitude of these interactions. Caution should be used when any of these drugs is coadministered with PLAVIX.

In addition to the above specific interaction studies, patients entered into clinical trials with PLAVIX received a variety of concomitant medications including **diuretics**, **beta-blocking agents**, **angiotensin converting enzyme inhibitors**, **calcium antagonists**, **cholesterol lowering agents**, **coronary vasodilators**, **antidiabetic agents** (including **insulin**), **antiepileptic agents**, **hormone replacement therapy**, **heparins** (unfractionated and LMWH) and **GPIIb/IIIa antagonists** without evidence of clinically significant adverse interactions. The use of oral anticoagulants, non-study anti-platelet drug and chronic NSAIDs was not allowed in CURE and there are no data on their concomitant use with clopidogrel.

#### Drug/Laboratory Test Interactions

None known.

#### Carcinogenesis, Mutagenesis, Impairment of Fertility

There was no evidence of tumorigenicity when clopidogrel was administered for 78 weeks to mice and 104 weeks to rats at dosages up to 77 mg/kg per day, which afforded plasma exposures >25 times that in humans at the recommended daily dose of 75 mg.

Clopidogrel was not genotoxic in four *in vitro* tests (Ames test, DNA-repair test in rat hepatocytes, gene mutation assay in Chinese hamster fibroblasts, and metaphase chromosome

analysis of human lymphocytes) and in one *in vivo* test (micronucleus test by oral route in mice).

Clopidogrel was found to have no effect on fertility of male and female rats at oral doses up to 400 mg/kg per day (52 times the recommended human dose on a mg/m<sup>2</sup> basis).

#### Pregnancy

**Pregnancy Category B.** Reproduction studies performed in rats and rabbits at doses up to 500 and 300 mg/kg/day (respectively, 65 and 78 times the recommended daily human dose on a mg/m<sup>2</sup> basis), revealed no evidence of impaired fertility or fetotoxicity due to clopidogrel. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of a human response, PLAVIX should be used during pregnancy only if clearly needed.

#### Nursing Mothers

Studies in rats have shown that clopidogrel and/or its metabolites are excreted in the milk. It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions in nursing infants, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the nursing woman.

#### Pediatric Use

Safety and effectiveness in the pediatric population have not been established.

#### Geriatric Use

Of the total number of subjects in controlled clinical studies, approximately 50% of patients treated with PLAVIX were 65 years of age and over. Approximately 16% of patients treated with PLAVIX were 75 years of age and over.

The observed difference in risk of thrombotic events with clopidogrel plus aspirin versus placebo plus aspirin by age category is provided in Figure 3 (see **CLINICAL STUDIES**). The observed difference in risk of bleeding events with clopidogrel plus aspirin versus placebo plus aspirin by age category is provided in Table 3 (see **ADVERSE REACTIONS**).

### ADVERSE REACTIONS

PLAVIX has been evaluated for safety in more than 17,500 patients, including over 9,000 patients treated for 1 year or more. The overall tolerability of PLAVIX in CAPRIE was similar to that of aspirin regardless of age, gender and race, with an approximately equal incidence (13%) of patients withdrawing from treatment because of adverse reactions. The clinically important adverse events observed in CAPRIE and CURE are discussed below.

**Hemorrhagic:** In CAPRIE patients receiving PLAVIX, gastrointestinal hemorrhage occurred at a rate of 2.0%, and required hospitalization in 0.7%. In patients receiving aspirin, the corresponding rates were 2.7% and 1.1%, respectively. The incidence of intracranial hemorrhage was 0.4% for PLAVIX compared to 0.5% for aspirin.

In CURE, PLAVIX use with aspirin was associated with an increase in bleeding compared to placebo with aspirin (see Table 3). There was an excess in major bleeding in patients receiving PLAVIX plus aspirin compared with placebo plus aspirin, primarily gastrointestinal and at puncture sites. The incidence of intracranial hemorrhage (0.1%), and fatal bleeding (0.2%), were the same in both groups.

The overall incidence of bleeding is described in Table 3 for patients receiving both PLAVIX and aspirin in CURE.

**Table 3: CURE Incidence of bleeding complications (% patients)**

Event	PLAVIX (+ aspirin)* (n=6259)	Placebo (+ aspirin)* (n=6303)	P-value
Major bleeding †	3.7 ‡	2.7 §	0.001
Life-threatening bleeding	2.2	1.8	0.13
Fatal	0.2	0.2	
5 g/dL hemoglobin drop	0.9	0.9	
Requiring surgical intervention	0.7	0.7	
Hemorrhagic strokes	0.1	0.1	
Requiring inotropes	0.5	0.5	
Requiring transfusion (≥4 units)	1.2	1.0	
Other major bleeding	1.6	1.0	0.005
Significantly disabling	0.4	0.3	
Intraocular bleeding with significant loss of vision	0.05	0.03	
Requiring 2-3 units of blood	1.3	0.9	
Minor bleeding ¶	5.1	2.4	<0.001

\* Other standard therapies were used as appropriate.

† Life threatening and other major bleeding.

‡ Major bleeding event rate for PLAVIX + aspirin was dose-dependent on aspirin: <100 mg=2.6%; 100-200 mg= 3.5%; >200 mg=4.9%

§ Major bleeding event rates for PLAVIX + aspirin by age were: <65 years = 2.5%, ≥65 to <75 years = 4.1%, ≥75 years 5.9%

¶ Led to interruption of study medication.

Ninety-two percent (92%) of the patients in the CURE study received heparin/LMWH, and the rate of bleeding in these patients was similar to the overall results.

There was no excess in major bleeds within seven days after coronary bypass graft surgery in patients who stopped therapy more than five days prior to surgery (event rate 4.4% PLAVIX + aspirin; 5.3% placebo + aspirin). In patients who remained on therapy within five days of bypass graft surgery, the event rate was 9.6% for PLAVIX + aspirin, and 6.3% for placebo + aspirin.

**Neutropenia/agranulocytosis:** Ticlopidine, a drug chemically similar to PLAVIX, is associated with a 0.8% rate of severe neutropenia (less than 450 neutrophils/μL). In CAPRIE severe neutropenia was observed in six patients, four on PLAVIX and two on aspirin. Two of the 9599 patients who received PLAVIX and none of the 9586 patients who received aspirin had neutrophil counts of zero. One of the four PLAVIX patients in CAPRIE was receiving cytotoxic chemotherapy, and another recovered and returned to the trial after only temporarily interrupting treatment with PLAVIX (clopidogrel bisulfate). In CURE, the numbers of patients with thrombocytopenia (19 PLAVIX + aspirin vs. 24 placebo + aspirin) or neutropenia (3 vs. 3) were similar.

Although the risk of myelotoxicity with PLAVIX (clopidogrel bisulfate) thus appears to be quite low, this possibility should be considered when a patient receiving PLAVIX demonstrates fever or other sign of infection.

**Gastrointestinal:** Overall, the incidence of gastrointestinal events (e.g. abdominal pain, dyspepsia, gastritis and constipation) in patients receiving PLAVIX (clopidogrel bisulfate) was 27.1%, compared to 29.8% in those receiving aspirin in the CAPRIE trial. In the CURE trial the incidence of these gastrointestinal events for patients receiving PLAVIX + aspirin was 11.7% compared to 12.5% for those receiving placebo + aspirin.

In the CAPRIE trial, the incidence of peptic, gastric or duodenal ulcers was 0.7% for PLAVIX (clopidogrel bisulfate) and 1.2% for aspirin. In the CURE trial the incidence of peptic, gastric or duodenal ulcers was 0.4% for PLAVIX + aspirin and 0.3% for placebo + aspirin.



Cases of diarrhea were reported in the CAPRIE trial in 4.5% of patients in the PLAVIX group compared to 3.4% in the aspirin group. However, these were rarely severe (PLAVIX=0.2% and aspirin=0.1%). In the CURE trial, the incidence of diarrhea for patients receiving PLAVIX + aspirin was 2.1% compared to 2.2% for those receiving placebo + aspirin.

In the CAPRIE trial, the incidence of patients withdrawing from treatment because of gastrointestinal adverse reactions was 3.2% for PLAVIX and 4.0% for aspirin. In the CURE trial, the incidence of patients withdrawing from treatment because of gastrointestinal adverse reactions was 0.9% for PLAVIX + aspirin compared with 0.8% for placebo + aspirin.

**Rash and Other Skin Disorders:** In the CAPRIE trial, the incidence of skin and appendage disorders in patients receiving PLAVIX was 15.8% (0.7% serious); the corresponding rate in aspirin patients was 13.1% (0.5% serious). In the CURE trial the incidence of rash or other skin disorders in patients receiving PLAVIX + aspirin was 4.0% compared to 3.5% for those receiving placebo + aspirin.

In the CAPRIE trial, the overall incidence of patients withdrawing from treatment because of skin and appendage disorders adverse reactions was 1.5% for PLAVIX and 0.8% for aspirin. In the CURE trial, the incidence of patients withdrawing because of skin and appendage disorders adverse reactions was 0.7% for PLAVIX + aspirin compared with 0.3% for placebo + aspirin.

Adverse events occurring in ≥2.5% of patients on PLAVIX in the CAPRIE controlled clinical trial are shown below regardless of relationship to PLAVIX. The median duration of therapy was 20 months, with a maximum of 3 years.

**Table 4: Adverse Events Occurring in ≥2.5% of PLAVIX Patients in CAPRIE**

Body System Event	% Incidence	(% Discontinuation)
	PLAVIX [n=9599]	Aspirin [n=9586]
<i>Body as a Whole – general disorders</i>		
Chest Pain	8.3 (0.2)	8.3 (0.3)
Accidental/Inflicted Injury	7.9 (0.1)	7.3 (0.1)
Influenza-like symptoms	7.5 (<0.1)	7.0 (<0.1)
Pain	6.4 (0.1)	6.3 (0.1)
Fatigue	3.3 (0.1)	3.4 (0.1)
<i>Cardiovascular disorders, general</i>		
Edema	4.1 (<0.1)	4.5 (<0.1)
Hypertension	4.3 (<0.1)	5.1 (<0.1)
<i>Central &amp; peripheral nervous system disorders</i>		
Headache	7.6 (0.3)	7.2 (0.2)
Dizziness	6.2 (0.2)	6.7 (0.3)
<i>Gastrointestinal system disorders</i>		
Abdominal pain	5.6 (0.7)	7.1 (1.0)
Dyspepsia	5.2 (0.6)	6.1 (0.7)
Diarrhea	4.5 (0.4)	3.4 (0.3)
Nausea	3.4 (0.5)	3.8 (0.4)
<i>Metabolic &amp; nutritional disorders</i>		
Hypercholesterolemia	4.0 (0)	4.4 (<0.1)
<i>Musculo-skeletal system disorders</i>		
Arthralgia	6.3 (0.1)	6.2 (0.1)
Back Pain	5.8 (0.1)	5.3 (<0.1)
<i>Platelet, bleeding, &amp; clotting disorders</i>		
Purpura/Bruise	5.3 (0.3)	3.7 (0.1)
Epistaxis	2.9 (0.2)	2.5 (0.1)
<i>Psychiatric disorders</i>		
Depression	3.6 (0.1)	3.9 (0.2)
<i>Respiratory system disorders</i>		
Upper resp tract infection	8.7 (<0.1)	8.3 (<0.1)
Dyspnea	4.5 (0.1)	4.7 (0.1)
Rhinitis	4.2 (0.1)	4.2 (<0.1)
Bronchitis	3.7 (0.1)	3.7 (0)
Coughing	3.1 (<0.1)	2.7 (<0.1)
<i>Skin &amp; appendage disorders</i>		
Rash	4.2 (0.5)	3.5 (0.2)
Pruritus	3.3 (0.3)	1.6 (0.1)
<i>Urinary system disorders</i>		
Urinary tract infection	3.1 (0)	3.5 (0.1)

Incidence of discontinuation, regardless of relationship to therapy, is shown in parentheses. Adverse events occurring in ≥2.0% of patients on PLAVIX in the CURE controlled clinical trial are shown below regardless of relationship to PLAVIX.

**Table 5: Adverse Events Occurring in ≥2.0% of PLAVIX Patients in CURE**

Body System Event	% Incidence	(% Discontinuation)
	PLAVIX (+ aspirin)* [n=6259]	Placebo (+ aspirin)* [n=6303]
<i>Body as a Whole – general disorders</i>		
Chest Pain	2.7 (<0.1)	2.8 (0.0)
<i>Central &amp; peripheral nervous system disorders</i>		
Headache	3.1 (0.1)	3.2 (0.1)
Dizziness	2.4 (0.1)	2.0 (<0.1)
<i>Gastrointestinal system disorders</i>		
Abdominal pain	2.3 (0.3)	2.8 (0.3)
Dyspepsia	2.0 (0.1)	1.9 (<0.1)
Diarrhea	2.1 (0.1)	2.2 (0.1)

\*Other standard therapies were used as appropriate.

Other adverse experiences of potential importance occurring in 1% to 2.5% of patients receiving PLAVIX (clopidogrel bisulfate) in the CAPRIE or CURE controlled clinical trials are listed below regardless of relationship to PLAVIX. In general, the incidence of these events was similar to that in patients receiving aspirin (in CAPRIE) or placebo + aspirin (in CURE).

**Autonomic Nervous System Disorders:** Syncope, Palpitation. **Cardiovascular disorders:** Cardiac failure. **Central and peripheral nervous system disorders:** Cramps legs, Hypoaesthesia, Neuralgia, Paraesthesia,

**Vertigo.** **Gastrointestinal system disorders:** Constipation, Vomiting. **Heart rate and rhythm disorders:** Fibrillation atrial. **Liver and biliary system disorders:** Hepatic enzymes increased. **Metabolic and nutritional disorders:** Gout, hyperuricemia, non-protein nitrogen (NPN) increased. **Musculo-skeletal system disorders:** Arthritis, Arthrosis. **Platelet, bleeding & clotting disorders:** GI hemorrhage, hematoma, platelets decreased. **Psychiatric disorders:** Anxiety, Insomnia. **Red blood cell disorders:** Anemia. **Respiratory system disorders:** Pneumonia, Sinusitis. **Skin and appendage disorders:** Eczema, Skin ulceration. **Urinary system disorders:** Cystitis. **Vision disorders:** Cataract, Conjunctivitis.

Other potentially serious adverse events which may be of clinical interest but were rarely reported (<1%) in patients who received PLAVIX in the CAPRIE or CURE controlled clinical trials are listed below regardless of relationship to PLAVIX. In general, the incidence of these events was similar to that in patients receiving aspirin (in CAPRIE) or placebo + aspirin (in CURE).

**Body as a whole:** Allergic reaction, necrosis ischemic. **Cardiovascular disorders:** Edema generalized. **Gastrointestinal system disorders:** Gastric ulcer perforated, gastritis hemorragic, upper GI ulcer hemorragic. **Liver and Biliary system disorders:** Bilirubinemia, hepatitis infectious, liver fatty. **Platelet, bleeding and clotting disorders:** hemarthrosis, hematuria, hemoptysis, hemorrhage intracranial, hemorrhage retroperitoneal, hemorrhage of operative wound, ocular hemorrhage, pulmonary hemorrhage, purpura allergic, thrombocytopenia. **Red blood cell disorders:** Anemia aplastic, anemia hypochromic. **Reproductive disorders, female:** Menorrhagia. **Respiratory system disorders:** Hemothorax. **Skin and appendage disorders:** Bullous eruption, rash erythematous, rash maculopapular, urticaria. **Urinary system disorders:** Abnormal renal function, acute renal failure. **White cell and reticuloendothelial system disorders:** Agranulocytosis, granulocytopenia, leukemia, leukopenia, neutrophils decreased.

**Postmarketing Experience**

The following events have been reported spontaneously from worldwide postmarketing experience:

- **Body as a whole:**
  - hypersensitivity reactions, anaphylactoid reactions, serum sickness
- **Central and Peripheral Nervous System disorders:**
  - confusion, hallucinations, taste disorders
- **Hepato-biliary disorders:**
  - abnormal liver function test, hepatitis (non-infectious), acute liver failure
- **Platelet, Bleeding and Clotting disorders:**
  - cases of bleeding with fatal outcome (especially intracranial, gastrointestinal and retroperitoneal hemorrhage)
  - thrombotic thrombocytopenic purpura (TTP) – some cases with fatal outcome- (see **WARNINGS**).
  - agranulocytosis, aplastic anemia/pancytopenia
  - conjunctival, ocular and retinal bleeding
- **Respiratory, thoracic and mediastinal disorders:**
  - bronchospasm, interstitial pneumonitis
- **Skin and subcutaneous tissue disorders:**
  - angioedema, erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis, lichen planus
- **Renal and urinary disorders:**
  - glomerulopathy, increased creatinine levels
- **Vascular disorders:**
  - vasculitis, hypotension
- **Gastrointestinal disorders:**
  - colitis (including ulcerative or lymphocytic colitis), pancreatitis, stomatitis
- **Musculoskeletal, connective tissue and bone disorders:**
  - myalgia

**OVERDOSAGE**

Overdose following clopidogrel administration may lead to prolonged bleeding time and subsequent bleeding complications. A single oral dose of clopidogrel at 1500 or 2000 mg/kg was lethal to mice and to rats and at 3000 mg/kg to baboons. Symptoms of acute toxicity were vomiting (in baboons), prostration, difficult breathing, and gastrointestinal hemorrhage in all species.

**Recommendations About Specific Treatment:**

Based on biological plausibility, platelet transfusion may be appropriate to reverse the pharmacological effects of PLAVIX if quick reversal is required.

**DOSAGE AND ADMINISTRATION**

**Recent MI, Recent Stroke, or Established Peripheral Arterial Disease**

The recommended daily dose of PLAVIX is 75 mg once daily.

**Acute Coronary Syndrome**

For patients with acute coronary syndrome (unstable angina/non-Q-wave MI), PLAVIX should be initiated with a single 300 mg loading dose and then continued at 75 mg once daily. Aspirin (75 mg-325 mg once daily) should be initiated and continued in combination with PLAVIX. In CURE, most patients with Acute Coronary Syndrome also received heparin acutely (see **CLINICAL STUDIES**).

PLAVIX can be administered with or without food.

No dosage adjustment is necessary for elderly patients or patients with renal disease. (See **Clinical Pharmacology: Special Populations.**)

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Brief Summary of Prescribing Information Revised February 2006

PLA-FEB06-B-Af





He was battling cancer both physically and financially, but A. J. Jones (top, at left, with his friend Tommy Smith) never let on. A coffee can on the gas station counter collected donations for him. A. J. graduated from high school in Crawford and was married there. He was 56 years old when he died. Kevin Westerfield (left) contemplates a javelina in the taxidermy studio he built behind his house.



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When news of a student's death in an automobile accident reached the football stadium, the game was cancelled. The Crawford junior varsity team prayed on the field before everyone was sent home. The next morning, little Mackenzie Leigh Ana Love Smith was born, coming home to the arms of her family—and to the community of Crawford—a few days later.



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# VISIONS OF EARTH





**Namib Desert, Namibia** A tenebrionid beetle faces downhill to help fog droplets roll toward its mouth. The insect may have evolved the behavior because rain is rare but fog abundant in this coastal desert.

PHOTO: OLIVIER GRUNEWALD





**Mkuze Game Reserve, South Africa** A speckled emperor moth diverts predators with an illusion. Patterns on its hind wings resemble a mammal's face, complete with glinting "pupils."









**Tarai Region, Nepal** Mahouts, or elephant handlers, guide their animals on an early morning ride through tall grass in Royal Chitwan National Park.





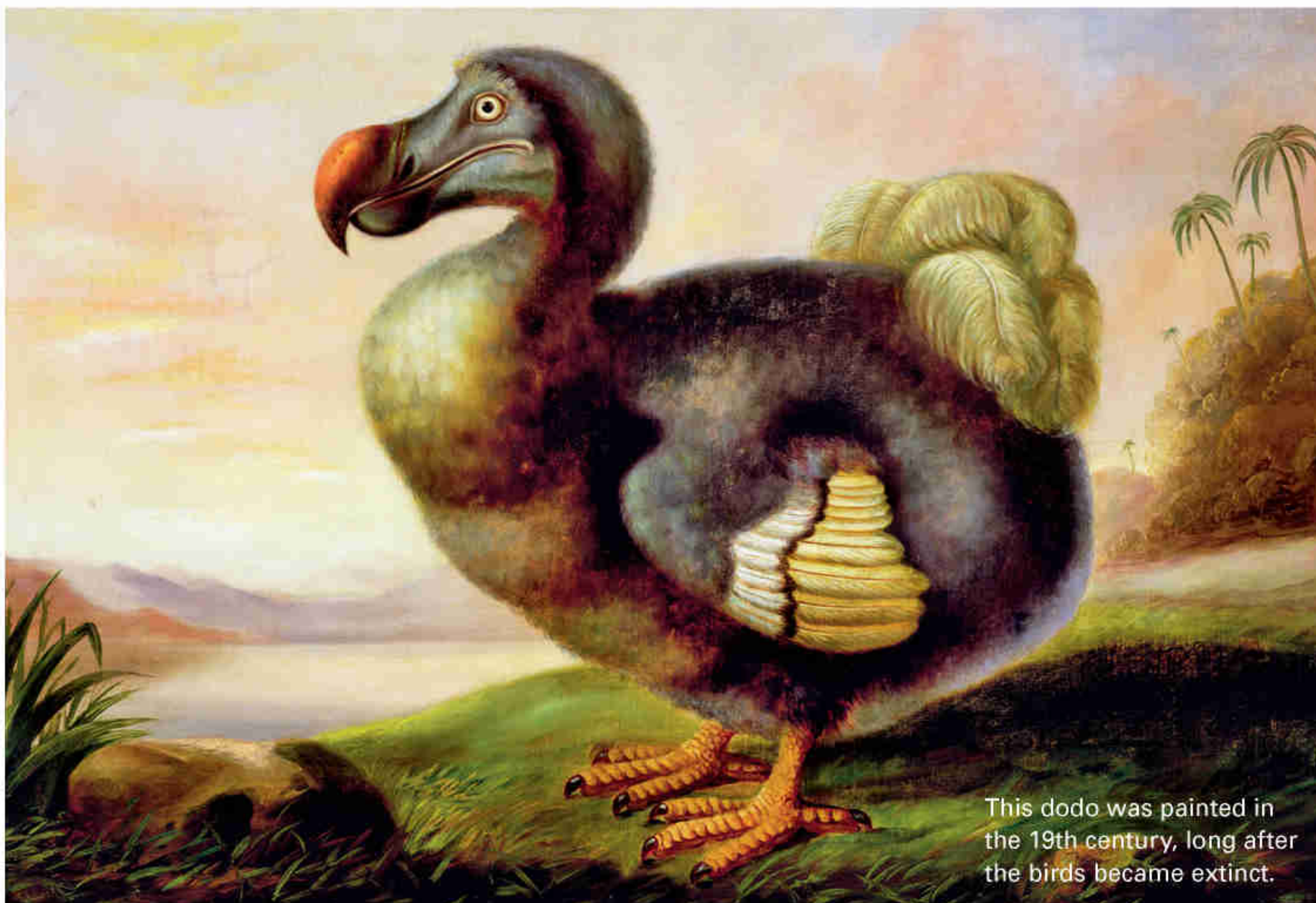
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PHOTO: AMY TOENSING





# F O S S I L S



This dodo was painted in the 19th century, long after the birds became extinct.

**Graveyard of the Dodos** They waddled rather than flew, laid single eggs, and lived in a world free of predators. But little else is known about the famously extinct dodo. Even its name has a hazy history—perhaps stemming from a Dutch phrase describing its tail feathers. Hunted relentlessly, the species disappeared from the island of Mauritius in the 17th century, less than 100 years after colonists arrived. No complete dodo skeleton has ever been found.



Dodo leg bones found on Mauritius

The recent discovery on Mauritius of the remains of some 20 dodos, along with the fossils of a thousand tortoises and dozens of other bird and plant species, promises to reveal more about dodos and their environment. All the bones were found in the same layer of earth and date back as far as 3,000 years. Kenneth Rijdsdijk of the Geological Survey of the Netherlands says that the find proves that tambalacoque and ebony trees, which now exist only in Mauritius's mountains, once flourished in the lowlands, and that dodos feasted on their fruits. Carbon dating currently under way should determine whether the animals died in one catastrophic event, such as flooding caused by a storm. —*Siobhan Roth*

## Fresh Dirt

**The earliest known wildfire** smoldered in England near the Welsh border some 418 million years ago. At the time, plants grew only an inch or so tall, and oxygen levels may have been higher than they are today. The combination resulted in a low-intensity burn that left plants preserved as charcoal fossils.

**Omo 1 and Omo 2**, partial skulls found by paleoanthropologist Richard Leakey in Ethiopia in 1967, were long thought to be a mere 130,000 years old. Recent tests reveal that they're the oldest *Homo sapiens* remains ever found. The Omos date back some 195,000 years, supporting the theory that modern humans arose in Africa.



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From St. Thomas, Tortola, and Virgin Gorda to Salt Island and Norman Island, the Virgin Islands are a nature lover's paradise. The waters boast colorful reef fish, schooling fish, and squid, and the area's gentle currents and rewarding shallow-water exploration make it enjoyable for children of all ages. "A lot of divers have some difficulty finding locations where they can travel with their family," says Skerry. "It's a natural classroom where kids can see so much in a small area."

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**T**O STUDY THE EXTERIOR LINES OF THE 2007 SL-CLASS IS TO STUDY A WORK OF ART. To carefully examine its mechanical systems, internal components and technological advancements is to behold another level of beauty altogether—and to understand the Mercedes-Benz definition of engineering.

The retractable hardtop is a marvel of its own. Eleven separate hydraulic cylinders work in concert to effortlessly conceal it within the trunk in a scant 16 seconds. And with the top up or down, the SL slices the air with an unmatched aerodynamic proficiency.

This car's impeccable handling is a product of both an exceptionally rigid body and a development known as Active Body Control. This system continuously stabilizes the car during cornering as well as acceleration and braking.

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## Ways to Go

When and how death will arrive can rarely be predicted, but statistics reveal what holds the greatest chance of ending a life. Riding a motorcycle, for example, is far riskier than playing with fireworks, statistically speaking. This chart shows what the lifetime probabilities are of a U.S. resident dying in a relatively common event, such as a pedestrian accident, or a less common but larger scale catastrophe, such as an earthquake. No matter what the cause, one thing is certain: No one gets out of here alive. —*Siobhan Roth*

**Total odds of dying, any cause**

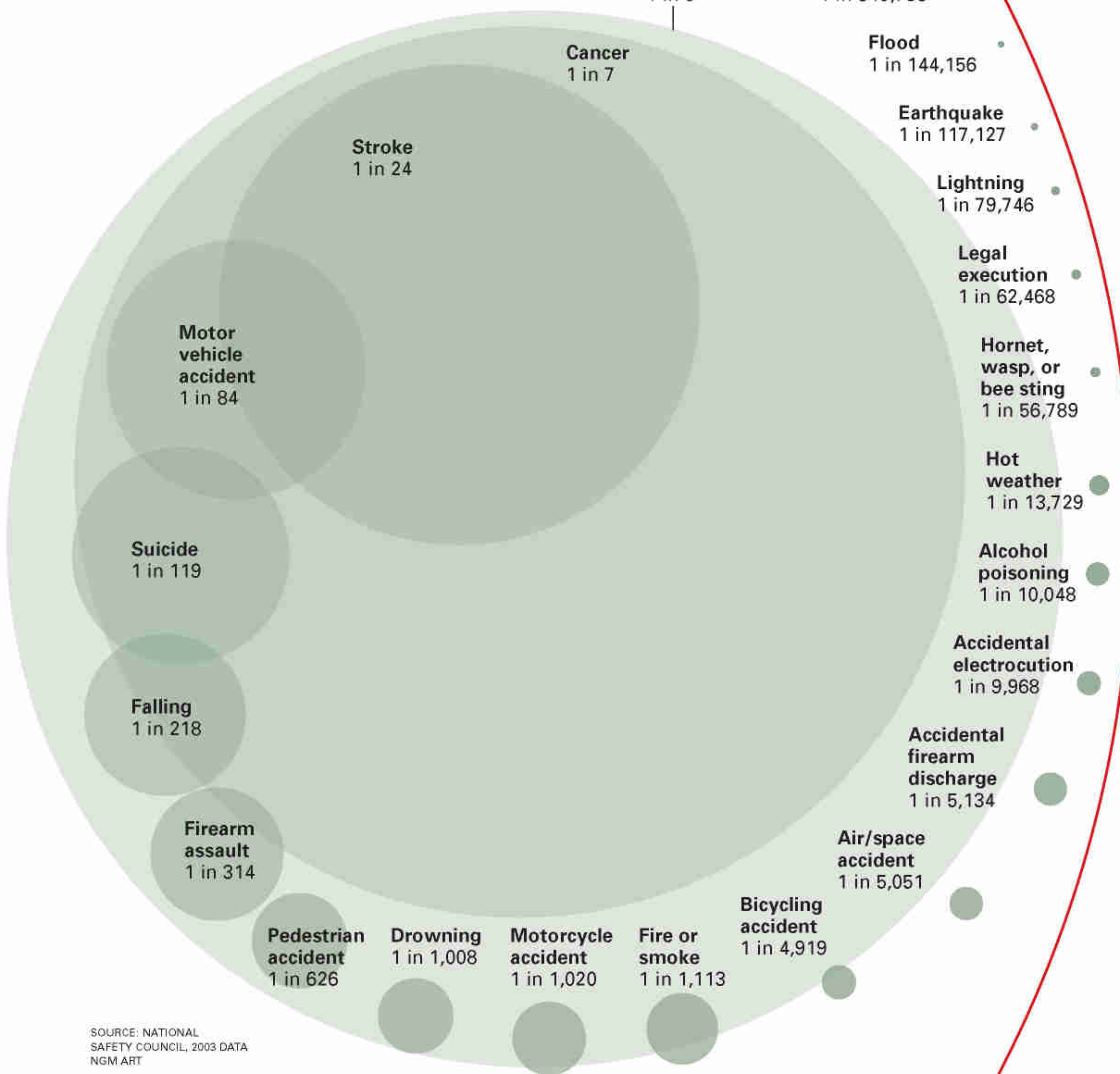
**1 in 1**  
(100%)

**GREATEST**

Heart disease  
1 in 5

**LEAST**

Fireworks discharge  
1 in 340,733





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A diver attaches a transmitter to help track a Nomura's jellyfish.

**Jelly Giant** It may look lethal, but its sting is only moderate: The worst injury the monsters—they can weigh as much as 400 pounds—known as Nomura's jellyfish inflict may be to the Japanese fishing industry. Last year a huge number of the animals showed up in the Sea of Japan, resulting in 100,000 complaints by fishermen about damaged nets and lost fishing time. Shin-ichi Uye, a biologist at Hiroshima University, believes that environmental changes, including global warming, increased nutrients in the water, and overfishing of jellyfish competitors for plankton may be boosting the population. He estimates the peak of immature, six-pound jellies floating to Japan in 2005 was "300 to 500 million a day—an amazing number!" —*John Eliot*

## What's New?

**By hitching a ride,** larvae of non-biting midges—aquatic insects resembling tiny mosquitoes—spread their range over great distances. The larvae travel inside the guts of migrating birds. Scientists studying insect dispersal by birds found the larvae when examining droppings of waterfowl that roosted in a Spanish marsh on their way south to Africa for the winter. Of the 95 intact larvae retrieved from the droppings, 12 were unharmed

by the journey through the birds' digestive tracts. According to the study, published in *Biology Letters*, the birds likely ingested the larvae during mid-migration gorging. When birds gorge, digestion becomes less efficient, allowing more larvae to survive.

**Scratch just a little lower.** Humans aren't the only animals to indicate where they want their backs scratched. Male chimpanzees in the Ngogo community

of Uganda's Kibale National Park were observed engaging in what scientists think is referential gestural communication, a behavior previously unknown in nonhumans in the wild. The chimps scratched certain spots on their bodies using exaggerated gestures to catch the attention of their grooming partners. In 64 percent of the observed instances, the groomer would scratch the other chimp in exactly the spot indicated.



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## Funny Money

J. S. G. Boggs never sells his art. He spends it. His project started in 1984 at a diner—a doodle of a dollar on a napkin to pay for a doughnut and coffee. He's since used the bills in transactions worth more than a million dollars. After creating, say, a ten Boggs bill, he finds a merchant who will accept it as the equivalent of ten dollars. Boggs then sells the receipt to an art collector, who must hunt down the bill. But Boggs's work exacts a price: He's been arrested in England and Australia for counterfeiting.



His drawings diverge from real banknotes in small details and a major difference: One side is always blank.

Boggs added his name to this bill, as well as the town and year in which he did the drawing.

Elaborate artwork mimics that on the Swiss franc's sixth banknote series, begun in 1976.

J. S. G. Boggs's visage replaces that of 17th-century architect Francesco Borromini on the Swiss bill.



Boggs drew this bill for the Florida United Numismatists, a banknote- and coin-collecting organization.

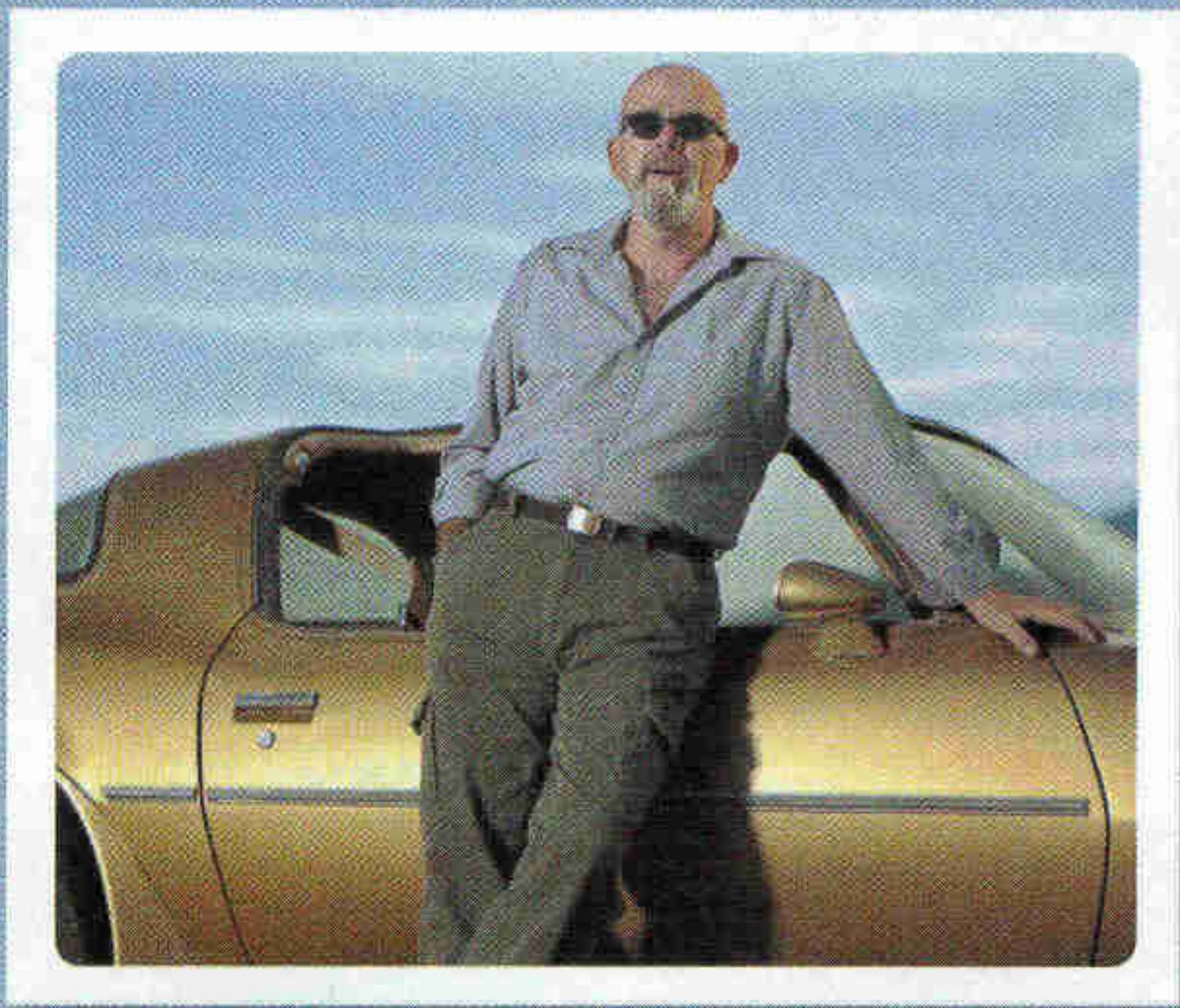
The Supreme Court building appears on this Boggs bill. Real ten-spots feature a similar-looking building—the U.S. Treasury.



This "FUNback" hails from "The United States of Florida." Boggs created several hundred of these bills.

"In Us We Trust" the FUNback proclaims. Boggs also flipped the two round images. On the U.S. dollar, the eagle sits on the right.





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By the early 1960s, when this picture was made, even some modestly priced homes came with air-conditioning.

**Birth of the Cool** One hundred years ago, Willis Carrier received a patent for a system to cool the air inside a building and control its humidity at the same time. It was the first modern air conditioner. Today nearly four-fifths of all U.S. homes are air-conditioned—96 percent in the sweltering South. As home air-conditioning has become more common, heat-related deaths nationwide have declined. But comfort has a cost: AC soaks up one-sixth of the electricity consumers buy each year. Stringent federal energy-efficiency standards for central air conditioners went into effect in January, and experts project that more efficient appliances will save consumers about 25 billion dollars between this summer and 2030. —Lynne Warren

## Culture Beat

**Michelangelo was here**, a newly uncovered signature suggests. The citizens of Marcialla, Italy, have long insisted that the master from Florence painted the fresco above their church's altar, a claim backed by 17th- and 18th-century church documents. Recently a stone slab forming part of the altar was moved, revealing the

letters M, B, and F—possibly M for Michelangelo, B for Buonarroti (the artist's surname), and F for *fecit*, Latin for “made,” or *fiorentino*, for “Florentine.”

**The number of meetings** that American workers attend more than doubled in the last half of the 20th century.

A study published in the *Journal of Applied Psychology* found that poorly run meetings strain workers' health, especially that of those who dislike meetings. The study also found that while many people complain about meetings, a large number secretly enjoy the confabs and derive a sense of well-being from the interaction.



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## WHERE IN THE WORLD?



Maelifell sits at the edge of a 270-square-mile glacier in southern Iceland.

**Volcanic View** Vegetation carpets the jagged cone of Maelifell, a peak in southern Iceland. Surrounded by gray glacial outwash and braided streams of meltwater, the 2,600-foot-tall volcano has not erupted in more than 10,000 years. Says volcanologist Lee Siebert, "It's safe to call this particular one extinct." The same cannot be said for the one beneath a nearby glacier called Mýrdalsjökull, at top. Sitting over a fissure where magma periodically rises to the surface, Mýrdalsjökull hides Katla, one of the most active volcanoes in Iceland. Katla last erupted in 1918 and could erupt again in the next decade, triggering flash floods that would threaten nearby farms and villages. —Whitney Dangerfield



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## What is the most important information I should know about ADVAIR DISKUS?

In patients with asthma, long-acting beta<sub>2</sub>-agonist medicines such as salmeterol (one of the medications in ADVAIR<sup>®</sup>) may increase the chance of death from asthma problems. In a large asthma study, more patients who used salmeterol died from asthma problems compared with patients who did not use salmeterol. So ADVAIR is not for patients whose asthma is well controlled on another asthma controller medicine such as low- to medium-dose inhaled corticosteroids or only need a fast-acting inhaler once in a while. Talk with your doctor about this risk and the benefits of treating your asthma with ADVAIR.

ADVAIR should not be used to treat a severe attack of asthma or chronic obstructive pulmonary disease (COPD) requiring emergency medical treatment.

ADVAIR should not be used to relieve sudden symptoms or sudden breathing problems. Always have a fast-acting inhaler with you to treat sudden breathing difficulty. If you do not have a fast-acting inhaler, contact your doctor to have one prescribed for you.

## What is ADVAIR DISKUS?

There are two medicines in ADVAIR: Fluticasone propionate, an inhaled anti-inflammatory belonging to a group of medicines commonly referred to as corticosteroids; and salmeterol, a long-acting, inhaled bronchodilator belonging to a group of medicines commonly referred to as beta<sub>2</sub>-agonists. There are 3 strengths of ADVAIR: 100/50, 250/50, 500/50.

### For Asthma

- ADVAIR is approved for the maintenance treatment of asthma in patients 4 years of age and older. ADVAIR should only be used if your doctor decides that another asthma controller medicine alone does not control your asthma or that you need 2 asthma controller medications.
- The strength of ADVAIR approved for patients ages 4 to 11 years who experience symptoms on an inhaled corticosteroid is ADVAIR DISKUS 100/50. All 3 strengths are approved for patients with asthma ages 12 years and older.

### For COPD associated with chronic bronchitis

ADVAIR 250/50 is the only approved dose for the maintenance treatment of airflow obstruction in patients with COPD associated with chronic bronchitis. The benefit of using ADVAIR for longer than 6 months has not been evaluated. The way anti-inflammatories work in the treatment of COPD is not well defined.

## Who should not take ADVAIR DISKUS?

You should not start ADVAIR if your asthma is becoming significantly or rapidly worse, which can be life threatening. Serious respiratory events, including death, have been reported in patients who started taking salmeterol in this situation, although it is not possible to tell whether salmeterol contributed to these events. This may also occur in patients with less severe asthma.

You should not take ADVAIR if you have had an allergic reaction to it or any of its components (salmeterol, fluticasone propionate, or lactose). Tell your doctor if you are allergic to ADVAIR, any other medications, or food products. If you experience an allergic reaction after taking ADVAIR, stop using ADVAIR immediately and contact your doctor. Allergic reactions are when you experience one or more of the following: choking; breathing problems; swelling of the face, mouth and/or tongue; rash; hives; itching; or welts on the skin.

## Tell your doctor about the following:

- If you are using your fast-acting inhaler more often or using more doses than you normally do (e.g., 4 or more inhalations of your fast-acting inhaler for 2 or more days in a row or a whole canister of your fast-acting inhaler in 8 weeks' time), it could be a sign that your asthma is getting worse. If this occurs, tell your doctor immediately.
- If you have been using your fast-acting inhaler regularly (e.g., four times a day). Your doctor may tell you to stop the regular use of these medications.
- If your peak flow meter results decrease. Your doctor will tell you the numbers that are right for you.
- If you have asthma and your symptoms do not improve after using ADVAIR regularly for 1 week.
- If you have been on an oral steroid, like prednisone, and are now using ADVAIR. You should be very careful as you may be less able to heal after surgery, infection, or serious injury. It takes a number of months for the body to recover its ability to make its own steroid hormones after use of oral steroids. Switching from an oral steroid may also unmask a condition previously suppressed by the oral steroid such as allergies, conjunctivitis, eczema, arthritis, and eosinophilic conditions. Symptoms of an eosinophilic condition can include rash, worsening breathing problems, heart complications, and/or feeling of "pins and needles" or numbness in the arms and legs. Talk to your doctor immediately if you experience any of these symptoms.
- Sometimes patients experience unexpected bronchospasm right after taking ADVAIR. This condition can be life threatening and if it occurs, you should immediately stop using ADVAIR and seek immediate medical attention.
- If you have any type of heart disease such as coronary artery disease, irregular heart beat or high blood pressure, ADVAIR should be used with caution. Be sure to talk with your doctor about your condition because salmeterol, one of the components of ADVAIR, may affect the heart by increasing heart rate and blood pressure. It may cause symptoms such as heart fluttering, chest pain, rapid heart rate, tremor, or nervousness.
- If you have seizures, overactive thyroid gland, liver problems, or are sensitive to certain medications for breathing.
- If your breathing problems get worse over time or if your fast-acting inhaler does not work as well for you while using ADVAIR. If your breathing problems worsen quickly, get emergency medical care.
- If you have been exposed to or currently have chickenpox or measles or if you have an immune system problem. Patients using medications that weaken the immune system are more likely to get infections than healthy individuals. ADVAIR contains a corticosteroid (fluticasone propionate) which may weaken the immune system. Infections like chickenpox and measles, for example, can be very serious or even fatal in susceptible patients using corticosteroids.

## How should I take ADVAIR DISKUS?

ADVAIR should be used 1 inhalation, twice a day (morning and evening). ADVAIR should never be taken more than 1 inhalation twice a day. The full benefit of taking ADVAIR may take 1 week or longer.

If you miss a dose of ADVAIR, just skip that dose. Take your next dose at your usual time. Do not take two doses at one time.

Do not stop using ADVAIR unless told to do so by your doctor because your symptoms might get worse.

Do not change or stop any of your medicines used to control or treat your breathing problems. Your doctor will adjust your medicines as needed.

## When using ADVAIR, remember:

- Never breathe into or take the DISKUS<sup>®</sup> apart.
- Always use the DISKUS in a level position.
- After each inhalation, rinse your mouth with water without swallowing.
- Never wash any part of the DISKUS. Always keep it in a dry place.
- Never take an extra dose, even if you feel you did not receive a dose.
- Discard 1 month after removal from the foil overwrap.
- Do not use ADVAIR with a spacer device.

Children should use ADVAIR with an adult's help as instructed by the child's doctor.

## Can I take ADVAIR DISKUS with other medications?

Tell your doctor about all the medications you take, including prescription and nonprescription medications, vitamins, and herbal supplements.

If you are taking ADVAIR, you should not take SEREVENT<sup>®</sup> DISKUS or Foradil<sup>®</sup> Aerolizer<sup>®</sup> for any reason.

If you take ritonavir (an HIV medication), tell your doctor. Ritonavir may interact with ADVAIR and could cause serious side effects. The anti-HIV medicines Norvir<sup>®</sup> Soft Gelatin Capsules, Norvir Oral Solution, and Kaletra<sup>®</sup> contain ritonavir.

No formal drug interaction studies have been performed with ADVAIR.

In clinical studies, there were no differences in effects on the heart when ADVAIR was taken with varying amounts of albuterol. The effect of using ADVAIR in patients with asthma while taking more than 9 puffs a day of albuterol has not been studied.

ADVAIR should be used with extreme caution during and up to 2 weeks after treatment with monoamine oxidase (MAO) inhibitors or tricyclic antidepressants since these medications can cause ADVAIR to have an even greater effect on the circulatory system.

ADVAIR should be used with caution in people who are taking ketoconazole (an antifungus medication) or other drugs broken down by the body in a similar way. These medications can cause ADVAIR to have greater steroid side effects.

Generally, people with asthma should not take beta-blockers because they counteract the effects of beta<sub>2</sub>-agonists and may also cause severe bronchospasm. However, in some cases, for instance, following a heart attack, selective beta-blockers may still be used if there is no acceptable alternative.

The ECG changes and/or low blood potassium that may occur with some diuretics may be made worse by ADVAIR, especially at higher-than-recommended doses. Caution should be used when these drugs are used together.

In clinical studies, there was no difference in side effects when ADVAIR was taken with methylxanthines (e.g., theophylline) or with FLONASE<sup>®</sup>.

## What are other important safety considerations with ADVAIR DISKUS?

**Osteoporosis:** Long-term use of inhaled corticosteroids may result in bone loss (osteoporosis). Patients who are at risk for increased bone loss (tobacco use, advanced age, inactive lifestyle, poor nutrition, family history of osteoporosis, or long-term use of drugs such as corticosteroids) may have a greater risk with ADVAIR. If you have risk factors for bone loss, you should talk to your doctor about ways to reduce your risk and whether you should have your bone density evaluated.

**Glaucoma and cataracts:** Glaucoma, increased pressure in the eyes, and cataracts have been reported with the use of inhaled steroids, including fluticasone propionate, a medicine contained in ADVAIR. Regular eye examinations should be considered if you are taking ADVAIR.

**Lower respiratory tract infection:** Lower respiratory tract infections, including pneumonia, have been reported with the use of inhaled corticosteroids, including ADVAIR.

**Blood sugar:** Salmeterol may affect blood sugar and/or cause low blood potassium in some patients, which could lead to a side effect like an irregular heart rate. Significant changes in blood sugar and blood potassium were seen infrequently in clinical studies with ADVAIR.

**Growth:** Inhaled steroids may cause a reduction in growth velocity in children and adolescents.

**Steroids:** Taking steroids can affect your body's ability to make its own steroid hormones, which are needed during infections and times of severe stress to your body, such as an operation. These effects can sometimes be seen with inhaled steroids (but it is more common with oral steroids), especially when taken at higher-than-recommended doses over a long period of time. In some cases, these effects may be severe. Inhaled steroids often help control symptoms with less side effects than oral steroids.

**Yeast infections:** Patients taking ADVAIR may develop yeast infections of the mouth and/or throat ("thrush") that should be treated by their doctor.

**Tuberculosis or other untreated infections:** ADVAIR should be used with caution, if at all, in patients with tuberculosis, herpes infections of the eye, or other untreated infections.

## What are the other possible side effects of ADVAIR DISKUS?

ADVAIR may produce side effects in some patients. In clinical studies, the most common side effects with ADVAIR included:

- |                                |                       |                                    |
|--------------------------------|-----------------------|------------------------------------|
| • Respiratory infections       | • Bronchitis          | • Musculoskeletal pain             |
| • Throat irritation            | • Cough               | • Dizziness                        |
| • Hoarseness                   | • Headaches           | • Fever                            |
| • Sinus infection              | • Nausea and vomiting | • Ear, nose, and throat infections |
| • Yeast infection of the mouth | • Diarrhea            | • Nosebleed                        |

Tell your doctor about any side effect that bothers you or that does not go away. These are not all the side effects with ADVAIR. Ask your doctor or pharmacist for more information.

## What if I am pregnant, planning to become pregnant, or nursing?

Talk to your doctor about the benefits and risks of using ADVAIR during pregnancy, labor, or if you are nursing. There have been no studies of ADVAIR used during pregnancy, labor, or in nursing women. Salmeterol is known to interfere with labor contractions. It is not known whether ADVAIR is excreted in breast milk, but other corticosteroids have been detected in human breast milk. Fluticasone propionate, like other corticosteroids, has been associated with birth defects in animals (e.g., cleft palate and fetal death). Salmeterol showed no effect on fertility in rats at 180 times the maximum recommended daily dose.

## What other important tests were conducted with ADVAIR?

There is no evidence of enhanced toxicity with ADVAIR compared with the components administered separately. In animal studies with doses much higher than those used in humans, salmeterol was associated with uterine tumors. Your healthcare professional can tell you more about how drugs are tested on animals and what the results of these tests may mean to your safety.

## For more information on ADVAIR DISKUS

This page is only a brief summary of important information about ADVAIR DISKUS. For more information, talk to your doctor. You can also visit [www.ADVAIR.com](http://www.ADVAIR.com) or call 1-888-825-5249. Patients receiving ADVAIR DISKUS should read the medication guide provided by the pharmacist with the prescription.

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## A Trip to Australia Reveals the Wonder of Giant Golden Pearls

Just before 1900, in a small isolated town called Broome Australia, fishermen came across the rarest oyster—a giant named the *Pinctada maxima*. This world's largest oyster contained the voluptuous South Sea Pearl—the most sought after pearl in the world. After this discovery, Broome soon became the dominant pearl trading post in the world and literally 80% of all worldwide pearl trading passed through Broome.

**A trip to Broome.** We took the long trip to Australia to study the famous white lipped oysters that produced magnificent pearls that are often 11-14mm—about 8 times the size of a standard cultured pearl. Not only did these oysters produce the rare South Sea pearl but they also produced tremendous amounts of mother of pearl or nacre. Nacre is the lustrous iridescent substance which is secreted by the oyster to form the shiny inside of their shells. When nacre secretions are deposited around the seed they build up to form a full sized pearl.

Our bioscientists went to work to see if we could help Mother Nature along a little. By extracting the seed pearl from young fresh oyster shells and speeding up the natural process by which the nacre coats the pearl, we are able to produce the breathtaking Australian Pacific Pearl.

**Golden beauties.** These golden pearls are extremely large in size—12mm—but they are much more consistent in shape than ordinary pearls that have to be extracted from 4-5 year old oysters that are dead. They are also less porous so you don't have to worry about perfumes or cosmetics discoloring these pearls like you do with ordinary pearls. In a more ecologically friendly approach, the Australian Pacific pearl seed is extracted from fresh oyster shells and then organically micro-coated in the laboratory with the same nacre that coats naturally grown pearls. Giant 12mm golden South Sea pearls can cost up to \$50,000 for an 18" strand. Why even think about that when you can now wear an 18" strand of

12mm Australian Pacific pearls with a consistently round shape and a rare golden color for under \$300.

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# A Deeper Shade of Green

BY BILL MCKIBBEN

*At times he can seem like a biblical prophet, lamenting how our human failings are destroying the planet. Yet listen more carefully to Bill McKibben—environmental essayist, activist, and author of the best seller *The End of Nature*—and you'll hear a redeeming message that transforms the idea of what "green" can mean.*

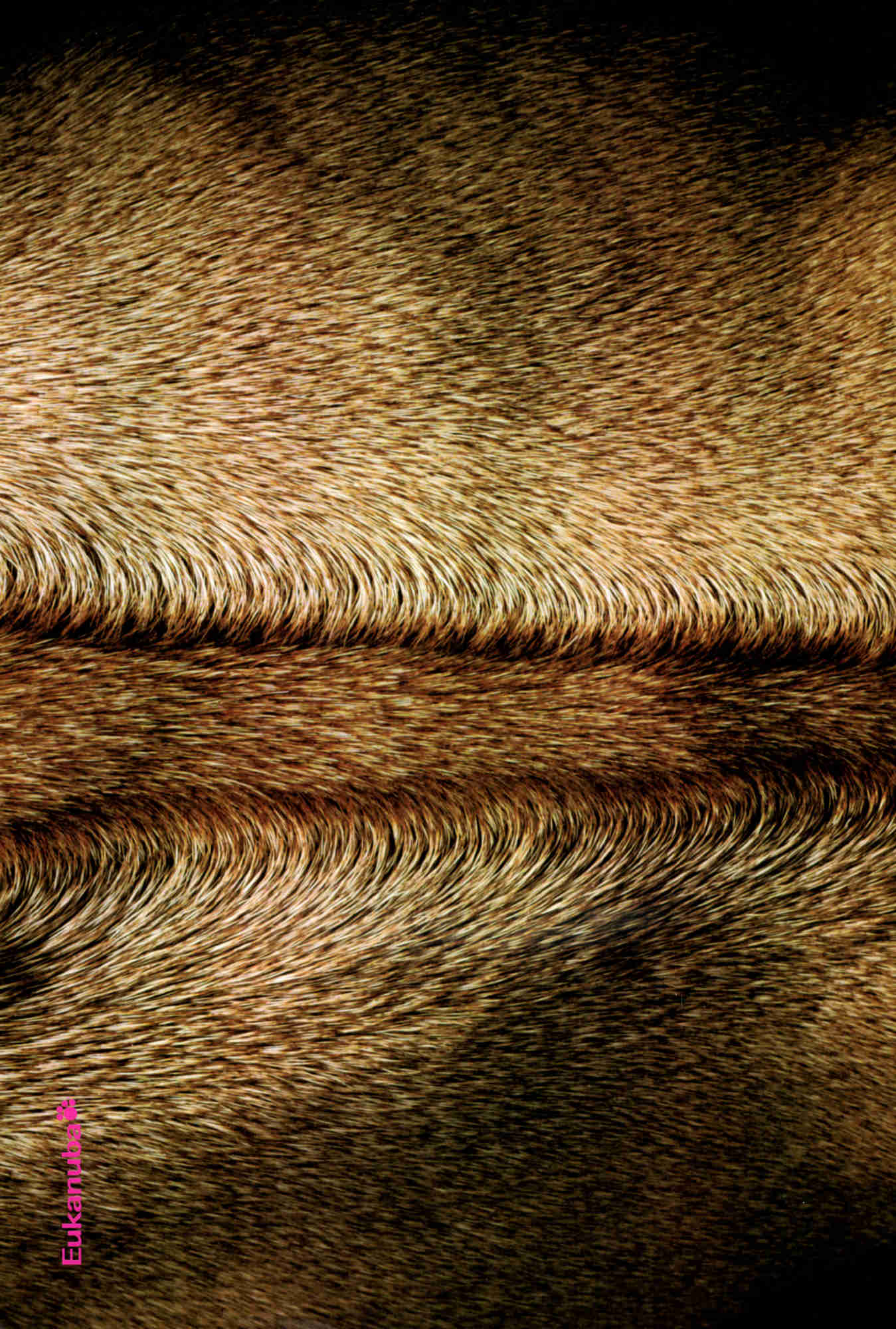
This is the year when we finally started to understand what we are in for. Exactly 12 months ago, an MIT professor named Kerry Emanuel published a paper in *Nature* showing that hurricanes had slowly but steadily been gaining in strength and duration for a generation. It didn't attract widespread attention for a few weeks—not until Katrina roared across the Gulf of Mexico and rendered half a million people refugees. The scenario kept repeating: Rita choking highways with fleeing Texans; Wilma setting an Atlantic Ocean record for barometric lows; Zeta spinning on New Year's Day. Meanwhile, other data kept pouring in from around the planet: Arctic sea ice melting past an irrevocable tipping point; thawing permafrost in northeastern Siberia creating so much methane that lakes didn't freeze even in the depths of boreal winter; the NASA calculation that 2005 had been the warmest year on record.

In January, a trinity of announcements sealed the mood. First, British scientist James Lovelock, who invented the instrument that allowed us to detect our eroding ozone layer, published an essay predicting that we'd already added too much CO<sub>2</sub> to the atmosphere and that runaway global warming was inevitable. He predicted that billions will die this century. A few days later came a less dramatic but equally alarming announcement. The steady and long-serving NASA climatologist James Hansen defied federal attempts to gag him and told reporters that new calculations about, among other things, the instability of Greenland's ice shelf showed "we can't let it go on another ten years like this." If we did? Over time, the buildup of CO<sub>2</sub> emissions would "imply changes that constitute practically a different planet." Less than ten years to reverse course. Not our kids' lifetimes, or our grandkids'. Ours.

Finally, at month's end, even President Bush, as faithful a friend as the fossil fuel industry has ever had, announced America was "addicted to oil." Historians, I think, will look back on this as the time when denial finally began to crumble. When we finally began to understand that the planet as we've known it was at stake—and not from a possible scenario, like nuclear war, but from the consumption of the coal and oil and gas that power most of the actions of our lives. This is new. Humans have never faced a civilization-scale challenge before. Whether we deal with

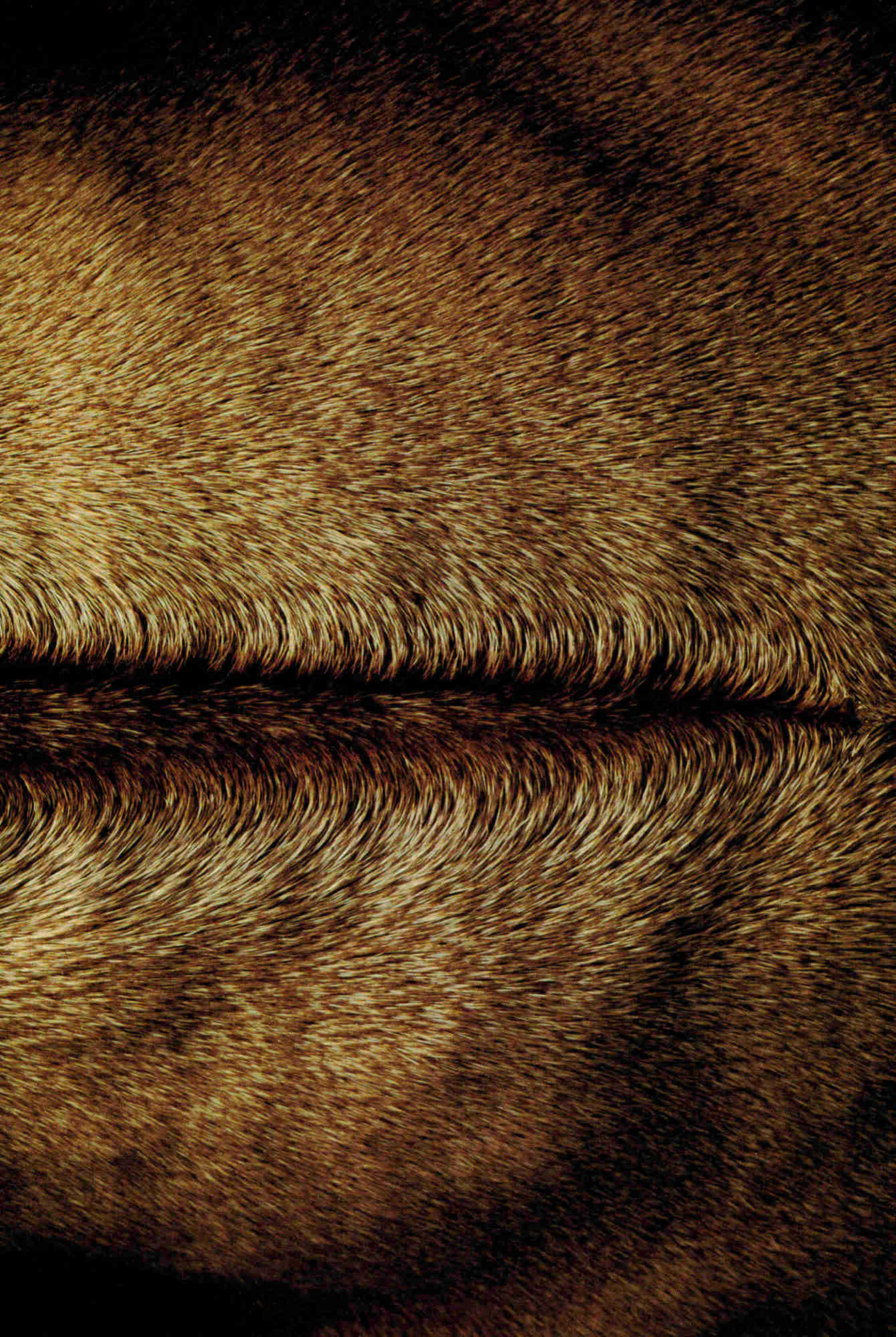
Bill McKibben lives in a Vermont valley, where he puts his ideas for a new cultural environmentalism into practice.





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Sprawling suburban developments, like this one in Las Vegas, Nevada, decentralize communities and create a car-dependent lifestyle.

it gracefully or not depends, I believe, on what happens to that creed we call environmentalism.

Environmentalism is mostly an American invention, one of the most powerful ideas we've offered to the rest of the planet. It arose here for a simple reason. We came to full consciousness while we were still in the process of subduing the nation's forests and prairies. In much of Asia and Europe, the woods were cut and the rivers tamed before the age of writers. Here, though, Henry David Thoreau could see the line between man and nature on his daily walks. George Perkins Marsh could watch what happened to the flow of streams when New England forests were cut down. Aldo Leopold could look on as the fierce green fire turned dull in the eyes of a gunned-down wolf.

None of these environmentalists, or the hundreds of thousands of other women and men who believed passionately in such ideas, were able to slow the economic juggernaut that rushed across this continent, however. Most didn't think of that as their role; it didn't even cross their minds. They set up small islands of park and wilderness for the tide to rush around. And they worked, especially after Rachel Carson, to cure modernity's most toxic side effects, making sure certain chemicals were banned and the Clean Air Act passed. This movement has been remarkably effective. Even as our economy has grown larger, smog has also abated. We can swim in most of our rivers again. And our model has spread to the rest of the world. Other countries have adopted their own clean air acts, built their own national parks. And environmentalists can still win great victories: The Sierra Club and the Wilderness Society and all the rest have managed so far, for instance, to preserve the Arctic National Wildlife Refuge from drilling.

But when it came time to deal with global warming, this kind of environmentalism flunked. Despite 20 years of increasingly dire warnings, American carbon emissions continue to grow; we won't even engage in the Kyoto Protocol, the one international effort to bring carbon emissions under some kind of control. A few western European nations are doing better, but even they are having trouble meeting their reduction targets. And the developing world is starting to flood the atmosphere with CO<sub>2</sub> on an almost American scale. From 1990 to 2004, China's carbon emissions increased by 67 percent, nearly all of it the result of coal.

We're now starting to realize this failure was almost inevitable. Environmentalism's method of handling global warming is flawed.

**T**he old paradigm works like this: We judge just about every issue by asking the question, Will this make the economy larger? If the answer is yes, then we embrace whatever is in question—globalization, factory farming, suburban sprawl. In this paradigm, the job of environmentalism is to cure the worst effects, and endless economic growth makes that job easier. If you're rich, you can more easily afford the catalytic converter for the end of the tailpipe that magically scrubs the sky above your city.





Clearly this dog's got a backbone. There it is, right under that amazing strip of hair that won't lay down no matter what the rest of the coat has to say about it. Like a Mohawk on a punk rocker, the ridgeback on the Rhodesian symbolizes the fearlessness of a dog who once hunted lions on the African savannah. We study all the breeds religiously and customize our food to give every dog exactly what it needs. FEED THE BREED.

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**The old paradigm works like this: We judge just about every issue by asking the question, Will this make the economy larger? But endless economic growth is built on the use of cheap fossil fuel.**

But it turns out that, above all else, endless economic growth is built on the use of cheap fossil fuel. The industrial revolution began the day in 1712 that Thomas Newcomen figured out how to use a steam engine to pump water out of a coal mine, so that it could be mined more cheaply and easily, thus allowing more steam engines. Coal, oil, and natural gas were, and are, miraculous—compact, easily transportable, crammed with Btu, and cheap. Dig a hole in the ground, stick a pipe in the right place, and you get all the energy you could ever need.

Precisely the same fuels that gave us our growth now threaten our civilization. Burn a gallon of gas and you release five pounds of carbon into the atmosphere. And as China demonstrates every day, the cheapest way to spur growth is by burning more fossil fuel. Even Benjamin Friedman, the Harvard economist who wrote a brilliant book last year defending the morality of economic growth, conceded that carbon dioxide is the one major environmental contaminant for which no study has ever found any indication of improvement as living standards rise.

Which means we might need a new idea. We need to stop asking, Will this make the economy larger? Instead, we need to start asking, Will this pour more carbon into the atmosphere? Some of the shift would be technological. If carbon carried a real price, then we'd be building windmills far faster than we are now. All cars would be hybrid cars, and all lightbulbs would be compact fluorescent. Every new coal plant would be paying the steep price to separate carbon from its exhaust stream and store it underground. All that would help—but not enough to meet Hansen's ten-year prognostication, not enough to reduce worldwide carbon emissions by the 70 percent required to stabilize the climate at its current degree of disruption.

For that to happen, we'd need to change as dramatically as our lightbulbs. We'd need to see ourselves differently—identity and desire would have to shift. Not out of a sense of idealism or asceticism or nostalgia for the '60s. Out of a sense of pure pragmatism.

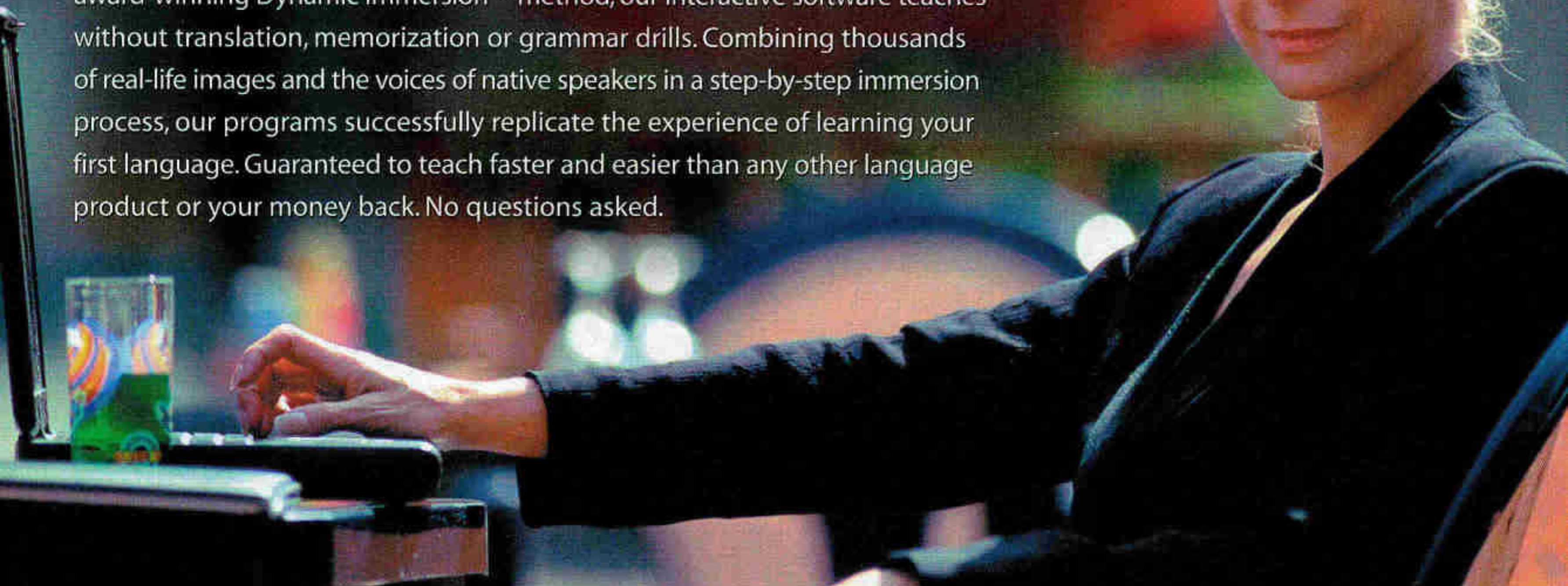
For instance, we've gotten used to eating across great distances. Because it's always summer somewhere, we've accustomed ourselves to a food system that delivers us fresh produce 365 days a year. The energy cost is incredible—growing and transporting a single calorie of iceberg lettuce from California to the eastern U.S. takes 36 calories of energy. What would it take to get us back to eating more locally, to accepting what the seasons and smaller scale local farmers provide?

Or think about the houses we now build. They're enormous—more than double the size they were in 1950, despite the fact that the number of people in the average home continues to fall. Even a technologically efficient furnace or air conditioner struggles to heat or cool such a giant space—and the houses can only be built on big suburban lots, guaranteeing that their occupants will be entirely car-dependent. What would it take to make us consider smaller homes, closer to the center of town, where we could use the bus or a bike for daily transportation?



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Farmers markets across the U.S. are growing in popularity. Eating what's grown locally reduces the cost of transporting food and fosters a "convivial environmentalism."

It would require, I think, a movement that takes people's aspirations for good and secure and durable lives seriously. That takes those desires more seriously even than the consumer economy has taken them. We would need a kind of cultural environmentalism that asks deeper questions than we're used to asking.

How deep? Here's a data set just as interesting as the ongoing spike in planetary temperatures—and almost as depressing. Since researchers started trying to measure such things in the years after World War II, the percentage of Americans who consider themselves "very happy" with their lives has remained steady, even though the material standard of living has nearly tripled in the same period. More stuff is not making us happier—but we can't break out of the cycle that offers more stuff as our only real goal.

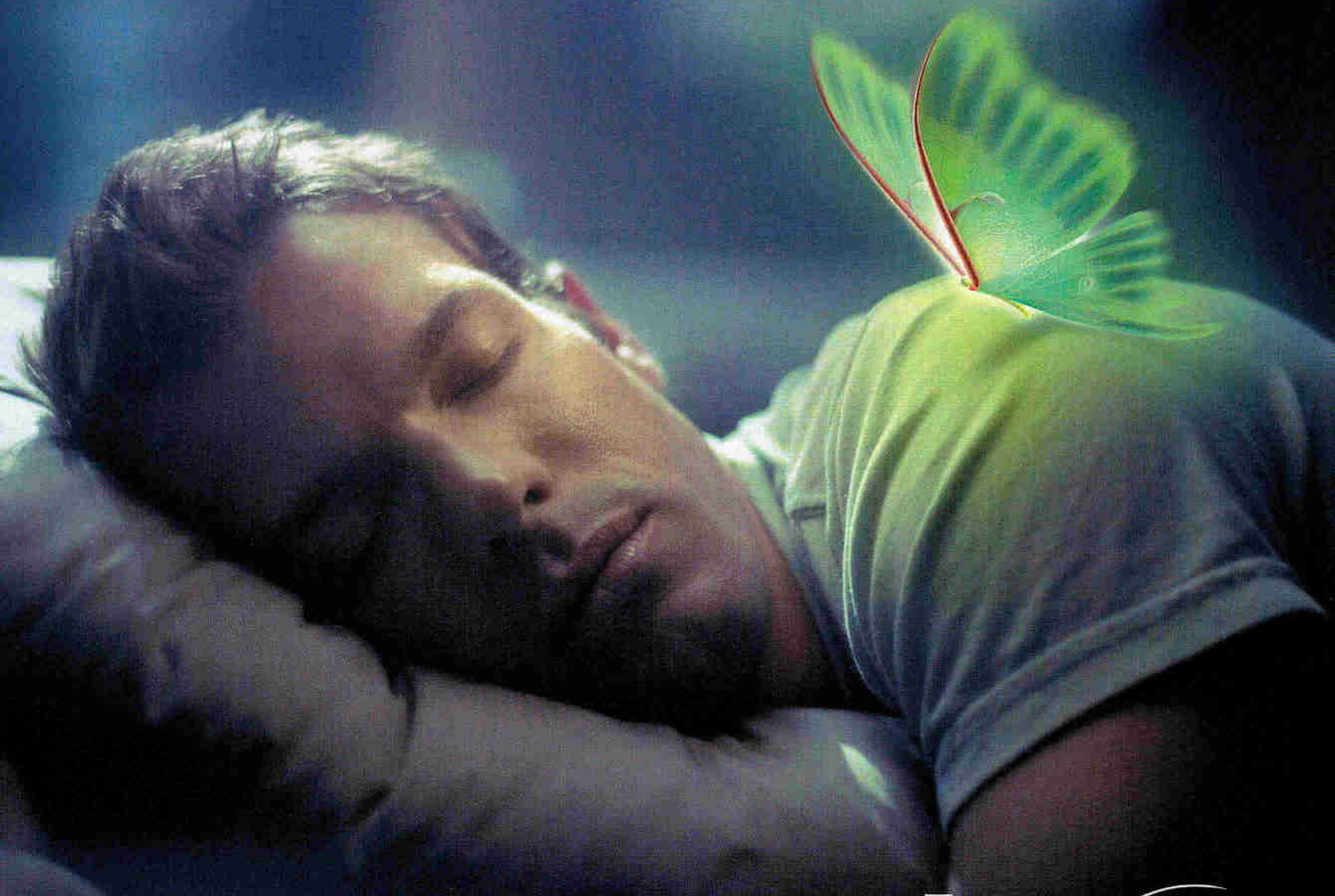
What we really seem to want, according to the economists and psychologists conducting such research, is more community. Standard economic theory has long assured us that we're insatiable bundles of desires. That may be true, but more and more it feels like our greatest wish is for more contact with other people. We've built the most hyper-individualized society the world has ever seen: According to some surveys, most Americans don't know their next-door neighbors, which is a truly novel idea for primates. That's contributed to the great success of our economy—each of us rises and falls based on our own efforts, which is a great motivator. But it's also contributed to that gathering sense of dissatisfaction, and to that cloud of carbon dioxide. If everyone has to drive their own car everywhere (and the biggest car possible, to maximize their own safety), then it's hard to reduce emissions. If our idea of paradise remains a 4,000-square-foot house on its own isolated lot, it's hard to imagine really rapid change.

But there are at least glimmers of another possible future. Consider food again. Last winter I conducted an experiment: Could I get through the cold months in my northern valley eating just the food grown in my county? As it turned out, I didn't simply survive; I thrived. There were plenty of potatoes and onions and beets and beef and cider and beer and wheat and eggs, and just enough tomatoes canned in the heat of summer, to see me through. I'm sure I saved lots of energy, though I can't calculate just how much. What I can list, though, are the new friends I made, and they numbered in the dozens. My food cost more in terms of time; it wasn't as convenient to go to the farmers market as to the Shop 'n Save. But that cost, thought of differently, was actually the biggest benefit of the whole experiment.

And I'm not alone. The number of farmers markets in the country has doubled in the past decade. Sales are growing at least 10 percent annually, making it among the fastest expanding parts of the food sector. A Saturday in Madison, Wisconsin, finds nearly 18,000 people shopping in the streets around the state capitol. In Burlington, Vermont's largest city, about 7 percent of the fresh food the populace eats is grown on just a hundred acres of



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**IMPORTANT SAFETY INFORMATION:** LUNESTA works quickly, and should be taken right before bed. Be sure you have at least eight hours to devote to sleep before becoming active. Until you know how you'll react to prescription LUNESTA, you should not drive or operate machinery. Do not use alcohol while taking LUNESTA. Most sleep medicines carry some risk of dependency. Side effects may include unpleasant taste, headache, drowsiness and dizziness. See important patient information on the next page.

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Please read this summary of information about LUNESTA before you talk to your doctor or start using LUNESTA. It is not meant to take the place of your doctor's instructions. If you have any questions about LUNESTA tablets, be sure to ask your doctor or pharmacist.

LUNESTA is used to treat different types of sleep problems, such as difficulty in falling asleep, difficulty in maintaining sleep during the night, and waking up too early in the morning. Most people with insomnia have more than one of these problems. You should take LUNESTA immediately before going to bed because of the risk of falling.

LUNESTA belongs to a group of medicines known as "hypnotics" or, simply, sleep medicines. There are many different sleep medicines available to help people sleep better. Insomnia is often transient and intermittent. It usually requires treatment for only a short time, usually 7 to 10 days up to 2 weeks. If your insomnia does not improve after 7 to 10 days of treatment, see your doctor, because it may be a sign of an underlying condition. Some people have chronic sleep problems that may require more prolonged use of sleep medicine. However, you should not use these medicines for long periods without talking with your doctor about the risks and benefits of prolonged use.

### Side Effects

All medicines have side effects. The most common side effects of sleep medicines are:

- Drowsiness
- Dizziness
- Lightheadedness
- Difficulty with coordination

Sleep medicines can make you sleepy during the day. How drowsy you feel depends upon how your body reacts to the medicine, which sleep medicine you are taking, and how large a dose your doctor has prescribed. Daytime drowsiness is best avoided by taking the lowest dose possible that will still help you sleep at night. Your doctor will work with you to find the dose of LUNESTA that is best for you. Some people taking LUNESTA have reported next-day sleepiness.

To manage these side effects while you are taking this medicine:

- When you first start taking LUNESTA or any other sleep medicine, until you know whether the medicine will still have some effect on you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
- Do not drink alcohol when you are taking LUNESTA or any sleep medicine. Alcohol can increase the side effects of LUNESTA or any other sleep medicine.
- Do not take any other medicines without asking your doctor first. This includes medicines you can buy without a prescription. Some medicines can cause drowsiness and are best avoided while taking LUNESTA.
- Always take the exact dose of LUNESTA prescribed by your doctor. Never change your dose without talking to your doctor first.

### Special Concerns

There are some special problems that may occur while taking sleep medicines.

#### Memory Problems

Sleep medicines may cause a special type of memory loss or "amnesia." When this occurs, a person may not remember what has happened for several hours after taking the medicine. This is usually not a problem since most people fall asleep after taking the medicine. Memory loss can be a problem, however, when sleep medicines are taken while traveling, such as during an airplane flight and the person wakes up before the effect of the medicine is gone. This has been called "traveler's amnesia." Memory problems have been reported rarely by patients taking LUNESTA in clinical studies. In most cases, memory problems can be avoided if you take LUNESTA only when you are able to

get a full night of sleep before you need to be active again. Be sure to talk to your doctor if you think you are having memory problems.

#### Tolerance

When sleep medicines are used every night for more than a few weeks, they may lose their effectiveness in helping you sleep. This is known as "tolerance." Development of tolerance to LUNESTA was not observed in a clinical study of 6 months' duration. Insomnia is often transient and intermittent, and prolonged use of sleep medicines is generally not necessary. Some people, though, have chronic sleep problems that may require more prolonged use of sleep medicine. If your sleep problems continue, consult your doctor, who will determine whether other measures are needed to overcome your sleep problems.

#### Dependence

Sleep medicines can cause dependence in some people, especially when these medicines are used regularly for longer than a few weeks or at high doses. Dependence is the need to continue taking a medicine because stopping it is unpleasant. When people develop dependence, stopping the medicine suddenly may cause unpleasant symptoms (see *Withdrawal* below). They may find they have to keep taking the medicine either at the prescribed dose or at increasing doses just to avoid withdrawal symptoms.

All people taking sleep medicines have some risk of becoming dependent on the medicine. However, people who have been dependent on alcohol or other drugs in the past may have a higher chance of becoming addicted to sleep medicines. This possibility must be considered before using these medicines for more than a few weeks. If you have been addicted to alcohol or drugs in the past, it is important to tell your doctor before starting LUNESTA or any sleep medicine.

#### Withdrawal

Withdrawal symptoms may occur when sleep medicines are stopped suddenly after being used daily for a long time. In some cases, these symptoms can occur even if the medicine has been used for only a week or two. In mild cases, withdrawal symptoms may include unpleasant feelings. In more severe cases, abdominal and muscle cramps, vomiting, sweating, shakiness, and, rarely, seizures may occur. These more severe withdrawal symptoms are very uncommon. Although withdrawal symptoms have not been observed in the relatively limited controlled trials experience with LUNESTA, there is, nevertheless, the risk of such events in association with the use of any sleep medicine.

Another problem that may occur when sleep medicines are stopped is known as "rebound insomnia." This means that a person may have more trouble sleeping the first few nights after the medicine is stopped than before starting the medicine. If you should experience rebound insomnia, do not get discouraged. This problem usually goes away on its own after 1 or 2 nights.

If you have been taking LUNESTA or any other sleep medicine for more than 1 or 2 weeks, do not stop taking it on your own. Always follow your doctor's directions.

#### Changes In Behavior And Thinking

Some people using sleep medicines have experienced unusual changes in their thinking and/or behavior. These effects are not common. However, they have included:

- More outgoing or aggressive behavior than normal
- Confusion
- Strange behavior
- Agitation
- Hallucinations
- Worsening of depression
- Suicidal thoughts

How often these effects occur depends on several factors, such as a person's general health, the use of other medicines, and which sleep medicine is being used. Clinical experience with LUNESTA suggests that it is rarely associated with these behavior changes.

It is also important to realize it is rarely clear whether these behavior changes are caused by the medicine, are caused by an illness, or have occurred on their own. In fact, sleep problems that do not



improve may be due to illnesses that were present before the medicine was used. If you or your family notice any changes in your behavior, or if you have any unusual or disturbing thoughts, call your doctor immediately.

#### Pregnancy And Breastfeeding

Sleep medicines may cause sedation or other potential effects in the unborn baby when used during the last weeks of pregnancy. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking LUNESTA.

In addition, a very small amount of LUNESTA may be present in breast milk after use of the medication. The effects of very small amounts of LUNESTA on an infant are not known; therefore, as with all other prescription sleep medicines, it is recommended that you not take LUNESTA if you are breastfeeding a baby.

#### Safe Use Of Sleep Medicines

To ensure the safe and effective use of LUNESTA or any other sleep medicine, you should observe the following cautions:

1. LUNESTA is a prescription medicine and should be used ONLY as directed by your doctor. Follow your doctor's instructions about how to take, when to take, and how long to take LUNESTA.
2. Never use LUNESTA or any other sleep medicine for longer than directed by your doctor.
3. If you notice any unusual and/or disturbing thoughts or behavior during treatment with LUNESTA or any other sleep medicine, contact your doctor.
4. Tell your doctor about any medicines you may be taking, including medicines you may buy without a prescription and herbal preparations. You should also tell your doctor if you drink alcohol. DO NOT use alcohol while taking LUNESTA or any other sleep medicine.
5. Do not take LUNESTA unless you are able to get 8 or more hours of sleep before you must be active again.
6. Do not increase the prescribed dose of LUNESTA or any other sleep medicine unless instructed by your doctor.
7. When you first start taking LUNESTA or any other sleep medicine, until you know whether the medicine will still have some effect on you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
8. Be aware that you may have more sleeping problems the first night or two after stopping any sleep medicine.
9. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, if you become pregnant, or if you are breastfeeding a baby while taking LUNESTA.
10. As with all prescription medicines, never share LUNESTA or any other sleep medicine with anyone else. Always store LUNESTA or any other sleep medicine in the original container and out of reach of children.
11. Be sure to tell your doctor if you suffer from depression.
12. LUNESTA works very quickly. You should only take LUNESTA immediately before going to bed.
13. For LUNESTA to work best, you should not take it with or immediately after a high-fat, heavy meal.
14. Some people, such as older adults (i.e., ages 65 and over) and people with liver disease, should start with the lower dose (1 mg) of LUNESTA. Your doctor may choose to start therapy at 2 mg. In general, adults under age 65 should be treated with 2 or 3 mg.
15. Each tablet is a single dose; do not crush or break the tablet.

**Note: This summary provides important information about LUNESTA. If you would like more information, ask your doctor or pharmacist to let you read the Prescribing Information and then discuss it with him or her.**

Rx only



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Standard economic theory has long assured us that we're insatiable bundles of desires. That may be true, but more and more it feels like our greatest wish is for more contact with other people.

community-supported farmland near the town's old dump. Some farmers markets cater to yuppies, and some are in housing projects; all bring people closer together.

And you can do the same kind of rethinking about many other parts of daily life, from transportation to housing to energy itself: Imagine a windmill at the end of your cul-de-sac, powering the ten homes along the street. You wouldn't be generating much carbon, and you would be generating lots of companionship.

**E**nvironmentalism has often been a somewhat grim business. (There is, after all, plenty to be grim about.) But a convivial environmentalism, one that asks us to figure out what we really want out of life, offers profound possibilities.

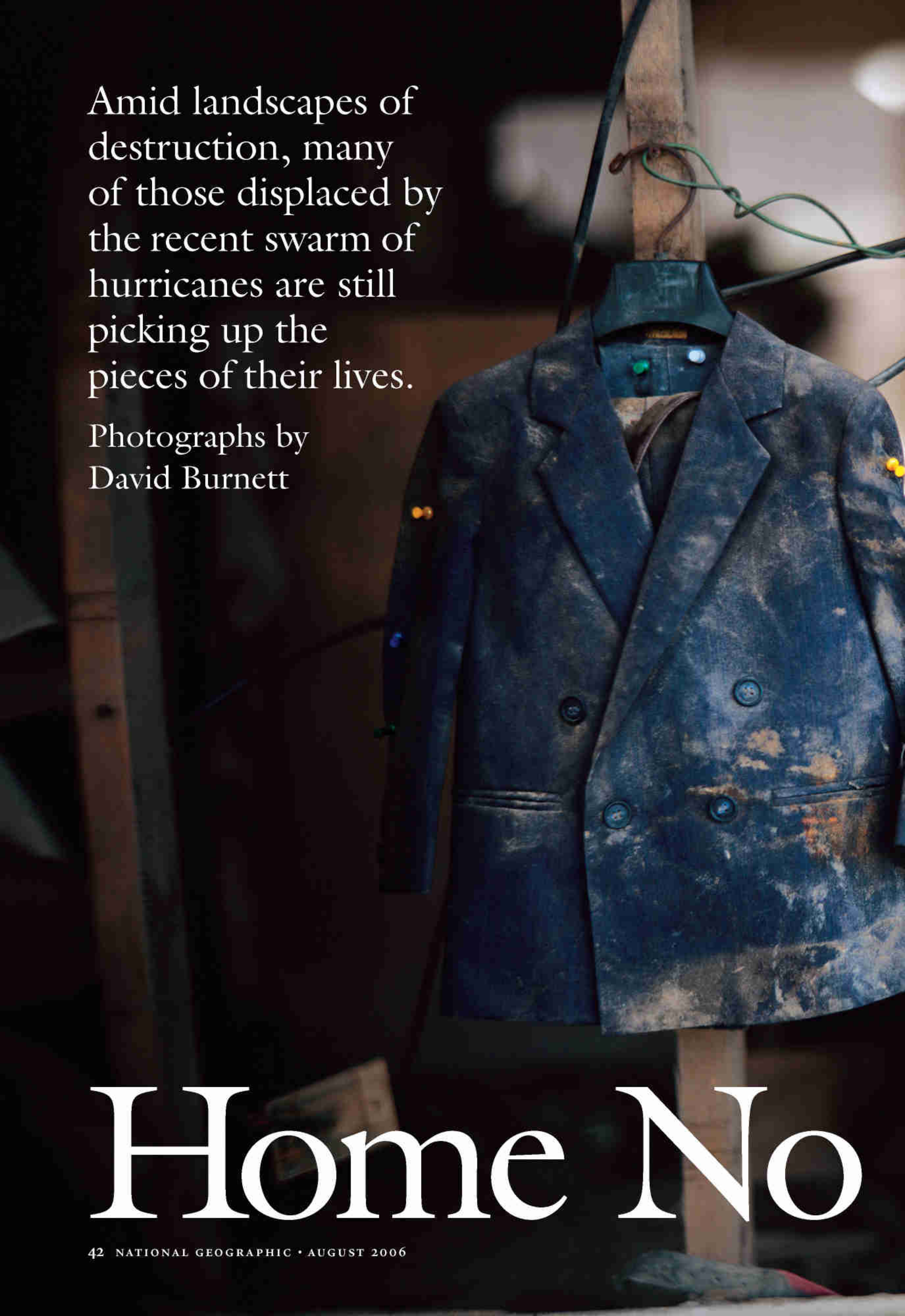
Perhaps the most important of those possibilities is a new link with communities of faith in this country. Though they don't always live up to their ideals, churches and synagogues and mosques are among the few institutions that can posit some idea for human existence other than accumulation. They understand that it's not just, as Bill Clinton's campaign asserted, "the economy, stupid." Their political help is crucial for making necessary legislative change—maybe the best news of the year was that some 90 prominent evangelical leaders broke ranks with Pat Robertson and his ilk to announce that they wanted to fight global warming, and fight it with their particular set of tools. "This is God's world," they said, which is a shocking idea for a culture that's come to think of everything as ours. It's precisely this ability of religious leaders of all stripes to see individuals as part of something larger than themselves that's so important. And also their commitment to taking care of the needy, because of course there are lots of people in the world who aren't rich. If we can't help them figure out some path to dignity other than our hyper-individualism, the math of global warming will never work.

We don't need to erase individualism; it is one of the glories of the American character. But environmentalists desperately need to learn how to celebrate community, too.

Environmentalism isn't dying. In fact, the need for it has never been greater. But it has to transform itself into something so different that the old name really won't apply. It has to be about a new kind of culture, not a new kind of filter; it has to pay as much attention to preachers and sociologists as it does to scientists; it has to care as much about the carrot in the farmers market as it does about the caribou on the Arctic tundra. That's what the printouts on atmospheric concentrations of carbon dioxide tell us, and it's a message echoed by the researchers studying happiness and satisfaction. We don't need a slightly rejiggered version of the world we now inhabit; we need to start working on changes on the scale of the problems we face.

Fear of what will happen unless we shift, desire for what might happen if we do—together they're creating new openings for a more thorough shake-up than any American thinker since Thoreau has envisioned. But ten years is not a lot of time; we'd best get started. □





Amid landscapes of  
destruction, many  
of those displaced by  
the recent swarm of  
hurricanes are still  
picking up the  
pieces of their lives.

Photographs by  
David Burnett

# Home No



## New Orleans

Hadi Amini returned to his ruined house, torn apart when Katrina's storm surge breached the 17th Street Canal levee last August, and found his seven-year-old son's dress-up clothes. "I hung them there to show how quickly life can change."



# More









### **New Orleans**

Houses and cars were half buried when the London Avenue Canal's floodwall gave way, unleashing water and sand. "The car is sitting in the front yard of the house next to my aunt and uncle's house," says Maureen Lillich. "They both drowned in the rushing water. I don't think the rest of the nation realizes the sorrow and struggle we continue to endure. All these months have passed, and my aunt and uncle's neighborhood still looks devastated."





## New Orleans

Herbert Gettridge and his wife raised nine children in this house, which he built with his own hands in 1953. When Hurricane Betsy flooded the Lower Ninth Ward in 1965, water approached the top of the decorative archways that Gettridge, a plasterer by trade, had shaped himself. A year ago Katrina filled the house to the ceiling, ruining Gettridge's extensive wardrobe—scores of suits, dozens of hats, closets

of accessories. But the house, built solid, suffered no structural damage, just a broken window-pane, and Gettridge, now 82, is steadily rehabilitating it. "I've been in the building trades all my life," he says. "I can still build anything I can think of."









Greetings from Holly Beach, Louisiana

MARK BURKE AND GERALD TOUCHET

## Holly Beach, Louisiana

"It was the poor man's Riviera," says Lecaster Leger, who owned one of the hundreds of tiny vacation houses washed away by Hurricane Rita's 15-foot storm surge last September. Because of new building regulations—larger lots, higher elevations—many people can't afford to rebuild. "It won't be poor man's anything anymore," Leger says.













## New Orleans

Six months after Katrina splintered the modest houses and wrecked the cars, the Lower Ninth Ward remained a scene of apocalypse and a reflection of lives thrown into chaos.

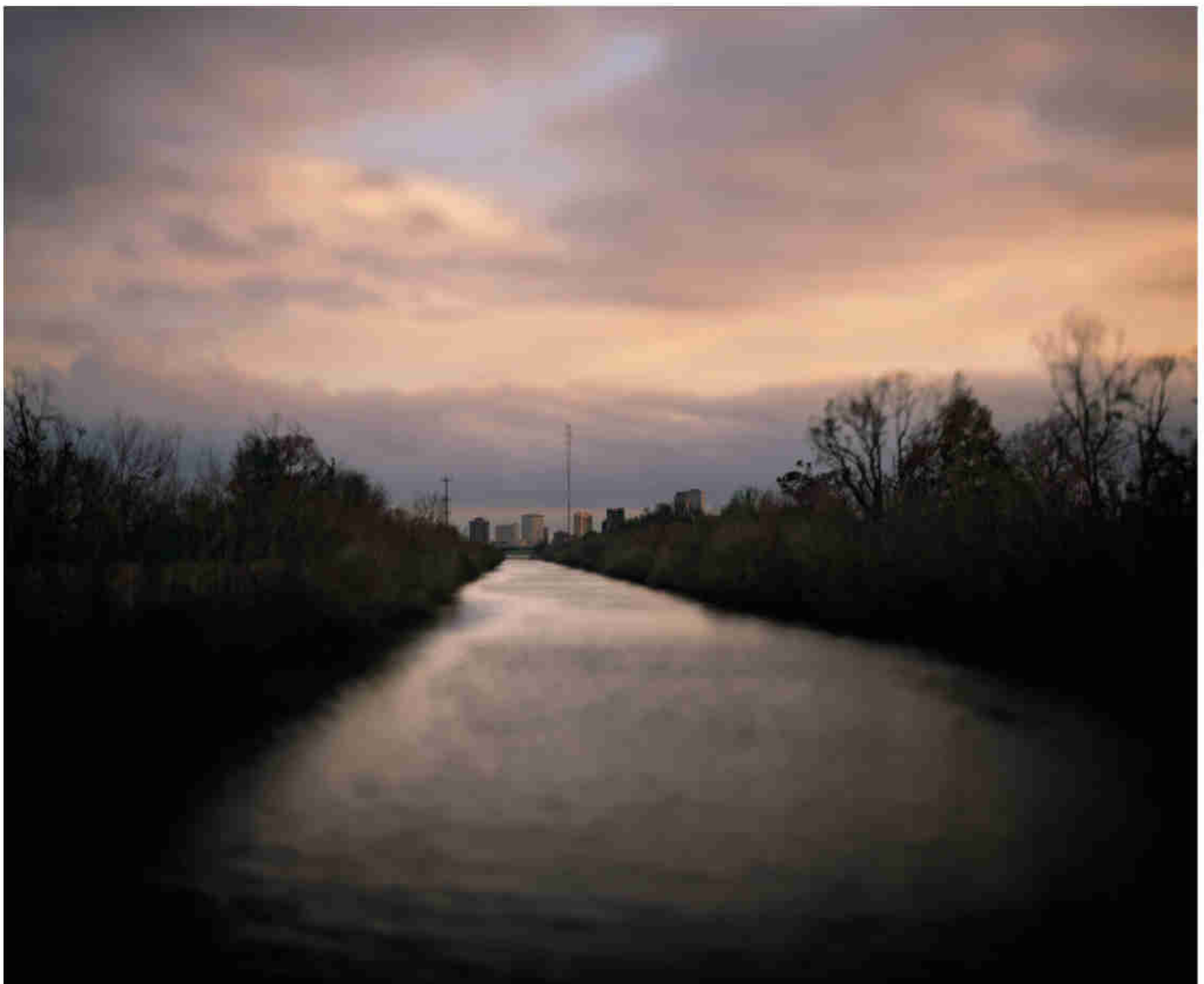




*Born and raised in coastal Louisiana, Ernest J. Gaines is the author of eight books of fiction, including*

# Where have you gone New Orleans?

by Ernest J. Gaines



**New Orleans** Built for drainage, the London Avenue Canal carried floodwaters into the city.



**Yes, New Orleans will bounce back.** Taxis and buses and limousines will leave hotels and casinos, cutting in and out of traffic to deliver passengers to Louis Armstrong International Airport. They will pass by homes and apartments and offices and neighborhood grocery stores and neighborhood bars that had been, now gone but for the debris.

Yes, New Orleans will bounce back, because the taxis and buses and limousines will bring people back from Louis Armstrong airport to hotels and casinos, passing by the debris of Katrina. New Orleans will come back because the debris of homes and lives will eventually be cleared away from the streets, and the people in the taxis and buses, and especially those in limousines, will look out the window and forget what had been. Yes, after clearing all the debris of clothing and toys and furniture—refrigerators and TV sets and armoires and chifforobes (bought from Sears, Roebuck in the forties) and dressers and washstands and old pianos—and handbags and tricycles and broken dishes and dolls with one arm and no head and old laceless boxing gloves—after all this has been cleared away, New Orleans will come back.

New Orleans will come back after the old sidewalks and potholes in the streets have been repaired. Yes, New Orleans will come back after bulldozers have knocked down homes in the Ninth Ward and cleared away all remnants of the people who lived there. New Orleans will come back when streetcars run up and down St. Charles Street, and tourists won't be afraid of getting off anywhere. New Orleans will come back when infrastructure is back in place on streets like Gentilly, when trees and flowers like azaleas and camelias and magnolias are blooming again on Esplanade. New Orleans will come back when you can go to Dooky Chase and order your favorite Creole meal, and later visit Snug Harbor, where the bartender knows exactly how you like your martini. Yes, for some New Orleans will come back.

There will be times when you can cross Bourbon Street in front of traffic, knowing all the time they won't dare hit you because this is the Big Easy, and you can do anything you like. You can walk down Royal Street and look into antique shops, dreaming but never buying. Or you can go to Café du Monde for beignets and café au lait. There will be musicians out on the sidewalk—they may not be the same ones as before Katrina, but there will be music. And



# Let us not worry, there will always be a New

there will be the old carriages, driven by old men, with tired old mules, and you can go for a ride in the French Quarter or along the French Market. . . .

Yes, New Orleans will come back after politicians have argued over what part of the city should be rebuilt, and what part of the city should not be rebuilt at all. There will be town meetings, and there will be private citizens screaming at politicians, but in the end New Orleans will be rebuilt. Let us not worry, there will always be a New Orleans.

But I imagine stories of loss, and I wonder.

**The Joseph sisters**—so we will call them, for this is only a story—used to walk two miles to church every Sunday in starched white dresses and white hats and white gloves. They walked Indian style on the narrow, broken sidewalk, the older sister in front, the younger one a pace or two behind. Every Sunday they would go to the nine o'clock service. They would come back a couple of hours later, take off their neat white dresses, hats, and gloves, and put on everyday wearing clothes and sit out on the porch. But Katrina changed all that. The older sister was drowned when six feet of water came into the house. The other sister was rescued and taken away. Some said she was taken to Houston, some said Detroit. Others said they believed she went to Atlanta, but they weren't sure.

Or imagine a man standing among the crowd on Canal Street watching the Mardi Gras floats go by. There were thousands of people, but the man remembered one voice, a little boy who called out to the floats: "Throw me something, mister, throw me something, throw me something, mister, throw me something." There were thousands and thousands of screaming voices, but the man remembered that one voice. Each time one of the revelers on the floats would throw something—a doubloon, a string of beads, a plastic horn, or a plastic whistle—someone else would get to the prize before the boy did. Then the man had the luck to catch a red plastic horn, but when he looked for the boy, the boy was not there. Who was that little boy? Where did he go? Why did he leave before he got his treasure? The man heard another voice behind him, a woman's, saying, "You gon' keep that little horn, mister? I got some beads for my little girl, but nothing for my little boy. He sure would like that little red horn."



# Orleans. But will it be my New Orleans?

That was years before Katrina. Two months after the storm, imagine this same man driving down South Claiborne Avenue, where he noticed a little red plastic horn on a pile of debris. He wondered if it could possibly be the same one he had given to the woman. No, no, it could not be. The people on the floats must have thrown thousands of those things since then. But he still wondered. What had happened to the woman? What had happened to her children? Were they alive, scattered all over the country, or were they dead?

There are other stories—true stories—just like these.

**New Orleans**, New Orleans, New Orleans, you will come back. But will you be my New Orleans, or the little boy's New Orleans, or the woman's New Orleans, or the Joseph sisters' New Orleans? I doubt it. Katrina and the politicians have made you a different New Orleans forever.

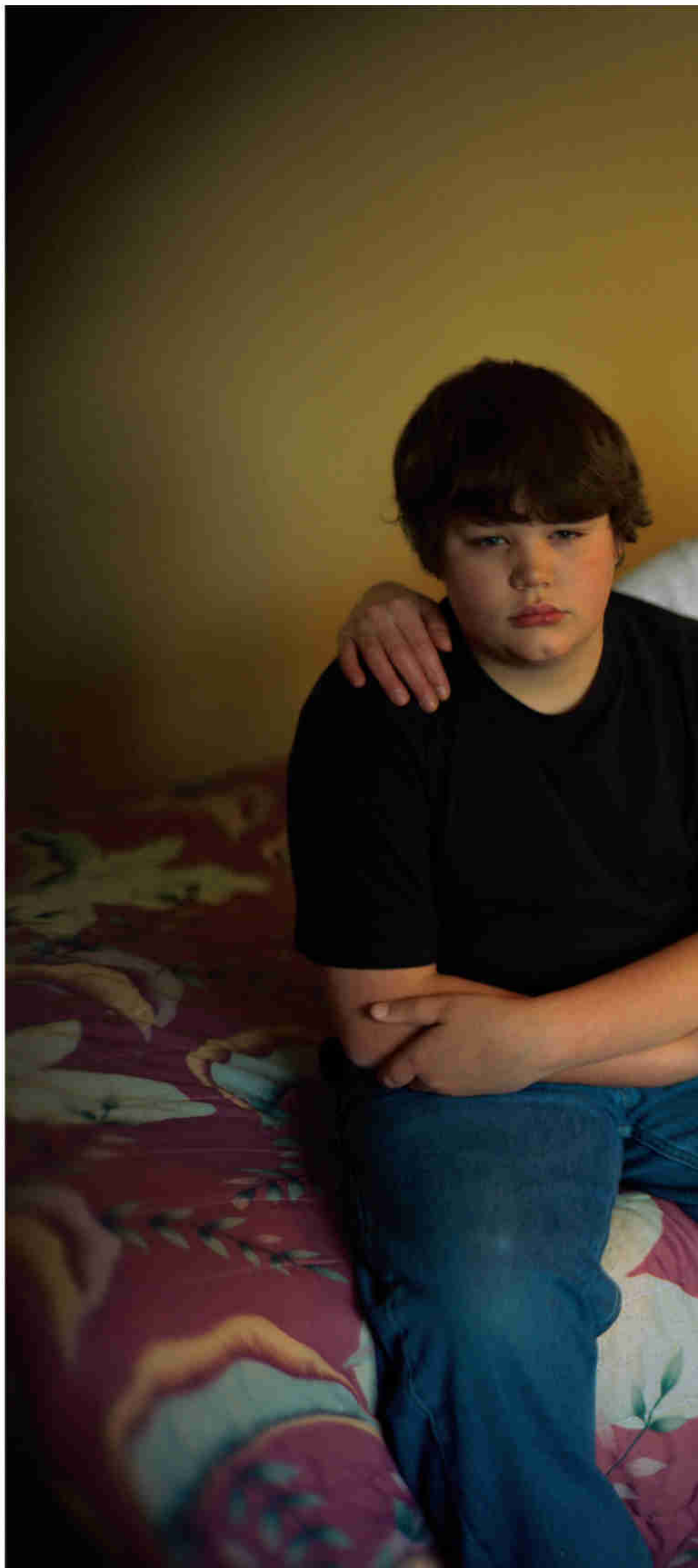


**New Orleans** Cracked mud uphollsters the pews of the Greater St. Rose Baptist Church in the Lower Ninth Ward, where water rose more than 12 feet after the Industrial Canal levee failed.



### **Baton Rouge, Louisiana**

Katrina felled a pine that cut the Jenkins family's trailer home in two. Since then, they've lived most of the time in a hotel room an hour away, cramped by salvaged possessions. Piles of hand-copied paperwork document their appeals to FEMA, the agency that pays for the room, for disaster aid to replace their uninsured trailer. "I don't know how we ever work our way out of this hole," says Delos Jenkins III, far right. He's disabled by a congenital heart defect, while his wife, Peggy, has frequent seizures. Son D. J., 12, separated from his friends and familiar school, now gets D's in subjects in which he once excelled.















### **New Orleans**

The force of rushing water blew out doors and windows of a house in the upscale Lakeview neighborhood, leaving only a handful of belongings (above) for homeowners to pick through. More than three million people were displaced by hurricanes Katrina, Rita, and Wilma. A year later, many of them are still scattered throughout the country.









### **Biloxi, Mississippi**

Harrah's Biloxi Grand Casino barge was condemned after Katrina swept it ashore. Even though Gulf Coast gambling palaces sustained severe damage (Katrina knocked out all 13 casinos on the Mississippi coast), they are one part of the local economy that is roaring back, to the relief of state and local officials, who collect hundreds of millions of dollars in gambling taxes. Three casinos were back in business by late 2005, and Harrah's said it would reopen the Grand this year.









### **Punta Gorda, Florida**

The FEMA trailer park is wedged between a cow pasture and a jail. More than a hundred white trailers filled with hurricane refugees are lined up on a field of blinding white sand and gravel. Fights and drug deals are common. "I wish we could go somewhere with houses and plants and colors," says Cory Arsenault, 14, who moved to the facility after Hurricane Charley tore up southwest Florida in 2004. The trailer park is overdue to be closed, and Cory's mother, who works in a day-care center, is seeking housing assistance so the family can move into an apartment nearby. □

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**Dramatic Effects** Photographer David Burnett demonstrates his unusual technique, and teenagers from New Orleans record Katrina's aftermath in words and pictures, at [ngm.com/0608](http://ngm.com/0608).



Think recent hurricanes were bad? Monster storms could become routine. Knowing when and where they will strike is a matter of life and death.

# Super Storms

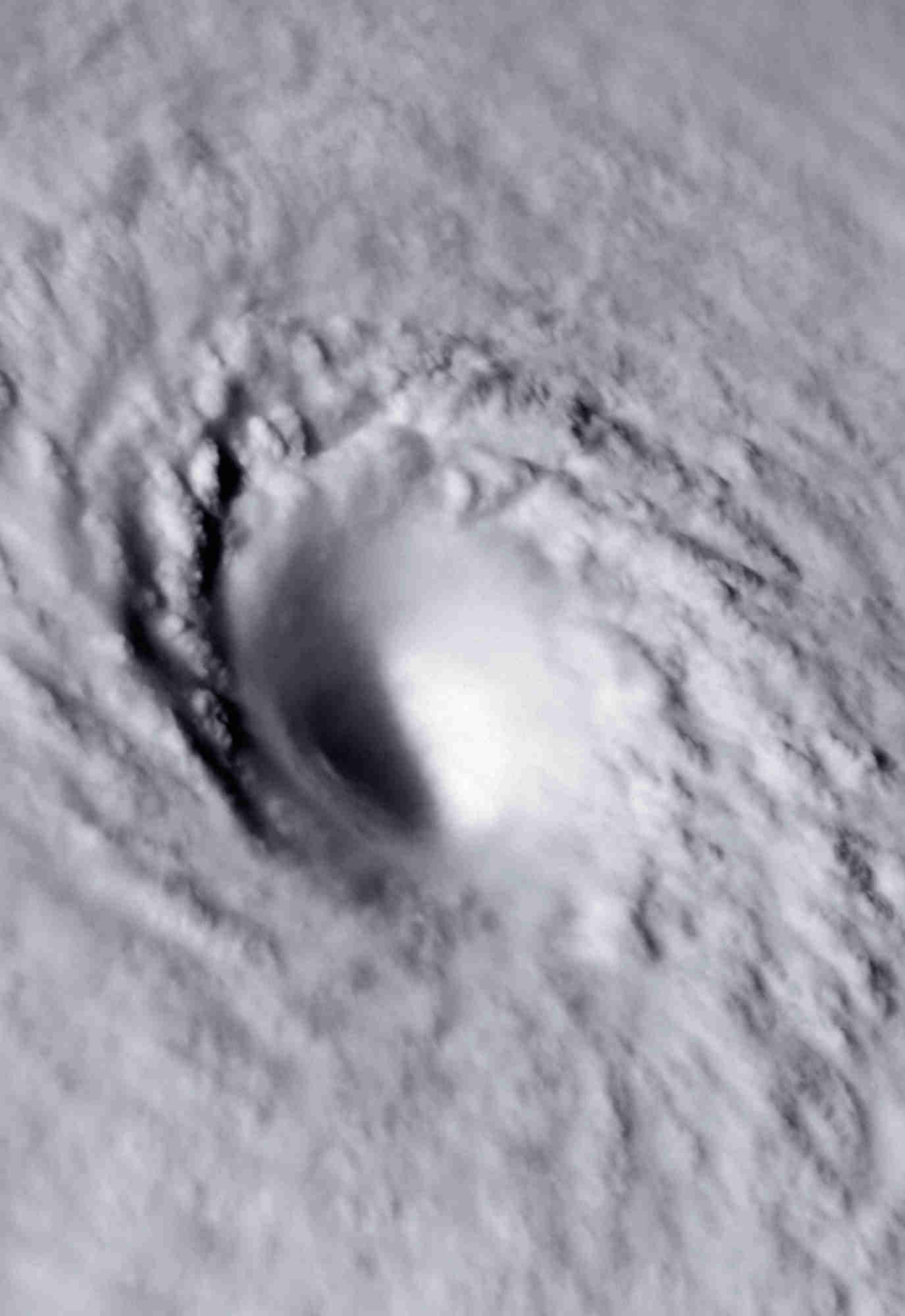
## No end in sight

### New Low

As Hurricane Wilma spun toward the Yucatán Peninsula on October 19, 2005 (the day this image was shot from the International Space Station), a hurricane hunter plane recorded an atmospheric pressure of 882 millibars in the eye of the storm. This record low drove winds of 185 mph and cemented Wilma's status as the most powerful Atlantic hurricane on record.









by Thomas Hayden

**W**hen the fiercest hurricane ever recorded in the Atlantic is bearing down on you, a salvaged armchair under a wood-and-tin awning might seem a poor choice of shelter. But that's where Don E. ("I'd rather keep my last name out of it") was parked when Wilma hit South Florida at 6:30 a.m. last October 24. For Don and a buddy, it was the start of the workday at Jimbo's Place, a ramshackle beer and bait shop down by the water on Miami's Virginia Key. "Once we got out here, it was kind of too late to do anything but ride it out," Don says with a small laugh.

Jimbo's looks like nothing so much as an abandoned shack. But whether through good luck or unexpectedly sound construction, it survived Wilma's fury. Mercifully, the winds had ebbed from 185 miles per hour at sea to 120 miles per hour by the time the storm hit, but Wilma still left almost all of South Florida without power. For the next two weeks a generator and donated bags of ice kept Jimbo's open—the only establishment on the key where visitors could be assured of a cold beer and a friendly welcome.

Wilma was a record breaker in a season of unsettling records. Katrina, at the end of August, killed more than a thousand people and left much of New Orleans and the neighboring coast in ruins. The damage exceeded a hundred billion dollars—the costliest natural disaster in U.S. history—and the toll in fractured lives is incalculable. Rita, in September, rivaled Wilma in intensity and ravaged the Gulf Coast through western Louisiana and East Texas.

These three monster storms were part of an unmatched run of Atlantic hurricanes—15 in all. With a total of 27 named tropical storms, 2005 was the first year meteorologists exhausted their preseason list of 21 Atlantic cyclone names and had to dip into the Greek alphabet for the latecomers.

Days after Wilma, one visitor to Jimbo's was already worrying about what future hurricane seasons might bring. Sharan Majumdar, 34, is a hurricane researcher at the University of Miami's Rosenstiel School of Marine and Atmospheric Science, just across the highway from Jimbo's. He is one of a cadre of scientists trying to under-

stand nature's most powerful storms and more reliably predict their surges, ebbs, and lurching paths from birth to landfall.

Swatting at sand flies on a warm November night, Majumdar says he can't really blame his fellow patrons at Jimbo's for deciding to stay put during Wilma. Forecasts today can get hurricane tracks wrong by hundreds of miles and wind speeds by tens of miles per hour. As a result, Majumdar says, "people often return after an evacuation to find nothing really happened." The solution, he says, is to improve forecasting through better science. "That's the only way to get people to trust the warnings."

The stakes have never been higher. Population is burgeoning along vulnerable coasts in the U.S., Asia, and the Caribbean. In the southeastern U.S., for example, coastal populations grew more than 50 percent from 1980 to 2003. The North Atlantic hurricane nursery, responding to a natural climate cycle, is experiencing a baby boom that isn't expected to end for a

### **2005: Year of the Hurricane**

It was a season for superlatives. Never before had a hurricane caused as much economic damage as Katrina. Never before had the Atlantic seen 27 named tropical storms—so many that the list of storm names had to be extended with Greek letters. Seven made landfall in the U.S. (lower right). Never had 15 hurricanes been spotted in one season, including four Category 5 storms (colored borders).





Arlene—June 11, 2005



Bret—June 28



Cindy—July 5



Dennis—July 7



Emily—July 14



Franklin—July 28



Gert—July 24



Harvey—Aug. 4



Irene—Aug. 16



Jose—Aug. 22



Katrina—Aug. 28



Lee—Aug. 31



Maria—Sept. 5



Nate—Sept. 7



Ophelia—Sept. 14



Philippe—Sept. 19



Rita—Sept. 21



Stan—Oct. 4



Tammy—Oct. 5



Vince—Oct. 9



Wilma—Oct. 19



Alpha—Oct. 22



Beta—Oct. 29



Gamma—Nov. 18



Delta—Nov. 25



Epsilon—Dec. 5



Zeta—Jan. 3, 2006







## “Mississippi and Alabama are pretty close to

decade or more. And behind it all lurks the grim possibility that global warming is making these storms stronger.

**L**ike all weather, hurricanes are fueled by heat—the heat of sun-drenched tropical seas, which powers the storms by sending warm, moist air rushing toward the frigid upper atmosphere like smoke up a chimney. As surrounding air is sucked in at the base of the storm, Earth’s rotation gives it a twist, creating a whorl of rain bands. These whip-tails of thunderstorm activity are strongest where they converge in a ring of rising, spinning air, the eyewall, which encloses the cloud-free eye.

Hurricanes (called typhoons in the western Pacific and tropical cyclones in the Indian Ocean) can propel themselves to an altitude of 50,000 feet or more, where the rising air finally vents itself in spiraling exhaust jets of cirrus clouds. The largest ever, the 1979 Pacific typhoon Tip, sent gale-force winds across more than 650 miles. Even an average hurricane packs some 1.5 trillion watts of power in its winds—equivalent to about half the world’s entire electrical generating capacity.

Starting this great weather engine requires surface waters of 80 degrees or more, moist air, and little wind shear—a difference in wind speed at the surface and aloft that can tear apart a developing hurricane. But those ingredients often produce nothing more than a tropical disturbance—an unremarkable cluster of thunderstorms. “Disturbances look very similar day to day,” says David Nolan of the Rosenstiel School, “and then all of a sudden you get a big burst of convection, then within six hours it becomes a

depression, then it becomes a hurricane, then it’s flooding my apartment.” Katrina soaked Nolan’s 14th-floor Miami Beach home as the storm crossed Florida on its fateful course to New Orleans and the Gulf Coast. “It would be really nice to say what you need to make a hurricane,” he adds. “And we really can’t do that yet.”

One thing was clear in 2005: Conditions were ideal for making hurricanes. From June through November—the official Atlantic hurricane season—bulletins and warnings streamed from the National Hurricane Center in Miami. But the most telling moment of the season came on November 29, one day before its official end, when NHC director Max Mayfield and other officials gave a summary report. Even as the officials recited a sobering roll call of power and destruction, the NHC duty forecaster was charting tropical storm Epsilon, just then getting ready to spin itself into yet another hurricane.

Yet 2005 was just a continuation of the upward trend that began in 1995. Because of a tropical climate shift that brought warmer waters and reduced wind shear, the Atlantic has spawned unusual numbers of hurricanes for nine of the past eleven seasons. “We’re 11 years into the cycle of high activity and landfall,” NOAA meteorologist Gerry Bell says, “but I can’t tell you if it will last another ten years, or thirty.”

Weather satellites make it easy for meteorologists to keep tabs on hurricanes. But ordinary satellite images show only the cloud tops. Spaceborne infrared sensors can reveal more detail, charting the size and shape of the warm eye, and satellite radar and microwave sensors can map the rain. Hurricane hunter aircraft actually fly





ideal for maximum storm surge.”

—RICK LUETTICH, UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

right into Atlantic hurricanes. But they only probe conditions at altitudes of several thousand feet, above the worst turbulence, Jack Beven of the NHC says—“not at the surface, where they really matter to people.”

Last year, though, scientists flew a robotic aircraft straight into the maelstrom when tropical storm Ophelia was parked off the mid-Atlantic coast. The craft, called Aerosonde, swooped and circled for ten hours, as low as 1,200 feet, monitoring winds and the flow of heat and moisture from the ocean into the storm.

That foray was a test, but forecasters routinely probe the heart of storms with shorter lived devices called dropsondes. Released from high-flying aircraft into hurricanes and the surrounding winds, these instrument-packed tubes descend by parachute. “They take about 15 minutes from 40,000 feet to splash,” Majumdar says. Along the way, they measure temperature, pressure, humidity, and wind every half second, transmitting it all to the airplane before they hit the water.

By cranking dropsonde data into computer models that can simulate a storm and how it is likely to evolve, researchers have sharpened their forecasts of storm tracks. Three-day forecasts of Atlantic storm positions were off by an average of 440 miles in the 1970s; by 2005 the average error had dropped to 173 miles. But one-day forecasts were still wide of the mark by an average of 70 miles—more than enough to keep coastal dwellers second-guessing the experts. The data and models still can’t capture storms in enough detail to forecast all of their feints and swerves.

Storm intensity is proving even harder to forecast. Three-day wind-speed forecasts, off by an

### A Devastated Shore

Twenty-five feet of water smashed into coastal Mississippi the morning Katrina hit, splintering buildings and killing hundreds of people. In Harrison County (western portion shown above) the water dumped ten-foot piles of debris hundreds of yards inland (red line)—enough, USGS coastal experts estimate, to fill 375,000 city garbage trucks. Scientists warn of the dangers of rebuilding within the debris zone, ground zero for surge in future hurricanes.

average of 23 miles per hour in the early 1990s, had improved only marginally by 2005. Hurricanes regularly surprise observers with their mood shifts. In a matter of hours, a Category 5 storm (winds over 155 mph) can fade to a Category 3 (111-130 mph), or a mere tropical storm can explode into a killer. “Intensity changes are the things that really hurt people,” says NOAA’s Bell.

The state of the ocean below a storm explains some intensity shifts. In 1995, tropical storm Opal was inching toward Category 1 status—an entry-level hurricane—as it made its way through the western Gulf of Mexico. Then, in just 14 hours, it surged to Category 4. Satellite readings of the warm sea surface showed nothing unusual. But Nick Shay of the Rosenstiel School and his colleagues discovered that the warm layer wasn’t limited to the top few yards of the ocean, as it usually is in the Gulf. Cold water at greater depths acts as a brake on hurricane



# Looking Inside a Hurricane

To understand how hurricanes work, and improve forecasts, researchers need detailed information from the heart of the storms. During the 2005 hurricane season, the most active on record, scientists investigated hurricanes from top to bottom (this one shown in cross section) with satellites, airplanes, and new kinds of instrumented probes.

DATA  
GATHERERS  
FROM TOP  
TO BOTTOM

▲  
**Satellites**  
500 to  
22,000 mi

## A In space

Satellites track a storm's shape and position and use heat-sensing infrared instruments to map its eye and most powerful updrafts.

## B In the storm

The Hurricane Rainband and Intensity Change Experiment (RAINEX) was the first to send NOAA and National Science Foundation aircraft on simultaneous flights through hurricanes, deploying three P-3 aircraft with Doppler radar through hurricane rain bands. The data showed how these rings of thunderstorms interact with the eyewall, where a hurricane's winds are strongest, to intensify or weaken a storm.

## C Close to the water

In September 2005, an unmanned aircraft called Aerosonde flew into the core of tropical storm Ophelia just 1,200 feet above the waves, monitoring how heat from the ocean was transferred to the storm.

## D In the ocean

Hurricanes Katrina and Rita strengthened dramatically when they crossed the Loop Current in the Gulf of Mexico. Ocean probes showed that the Loop Current's warmth extended to a depth of 300 feet, increasing the supply of heat to the storms. As a hurricane nears land, its winds pile up a destructive hill of water called storm surge.

**Dropsondes**  
Dropped from planes, these probes relay measurements of pressure, wind speed and direction, humidity, and temperature as they fall to the sea.

▲  
**G-IV jet aircraft**  
42,000 ft

▲  
**P-3 propeller aircraft**  
8,000, 12,000,  
and 14,000 ft

▲  
**Aerosonde**  
1,200 ft

●  
**Ocean probes**  
Dropped from planes, these probes then sink, measuring conditions to a depth of over 3,000 feet.

Rain band

Rain band

Eyewall

Hurricane's path

Storm surge

Deeper layers of warm water

Cool water



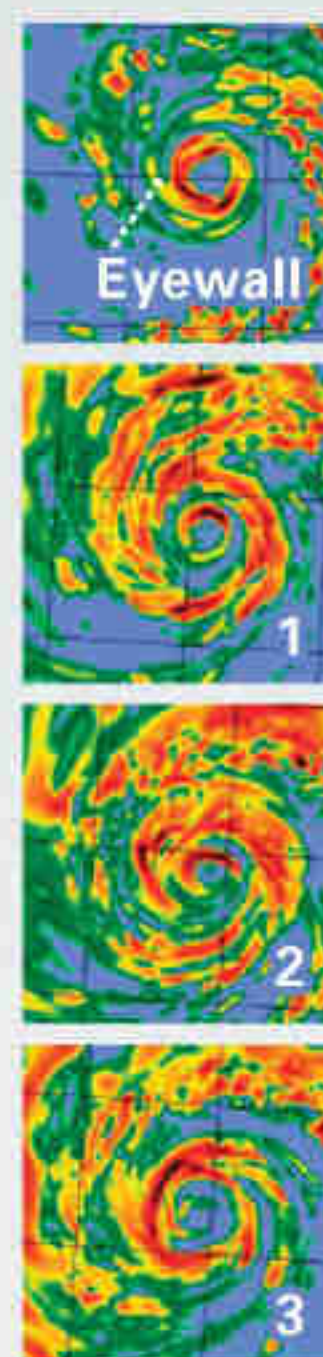


### Clues to Intensity

An image of Hurricane Rita based on infrared data from NASA's Tropical Rainfall Measuring Mission (TRMM) satellite reveals a pair of chimney clouds, called hot towers, reaching more than 11 miles high. First observed in 1998, hot towers may indicate that the storm is about to intensify.

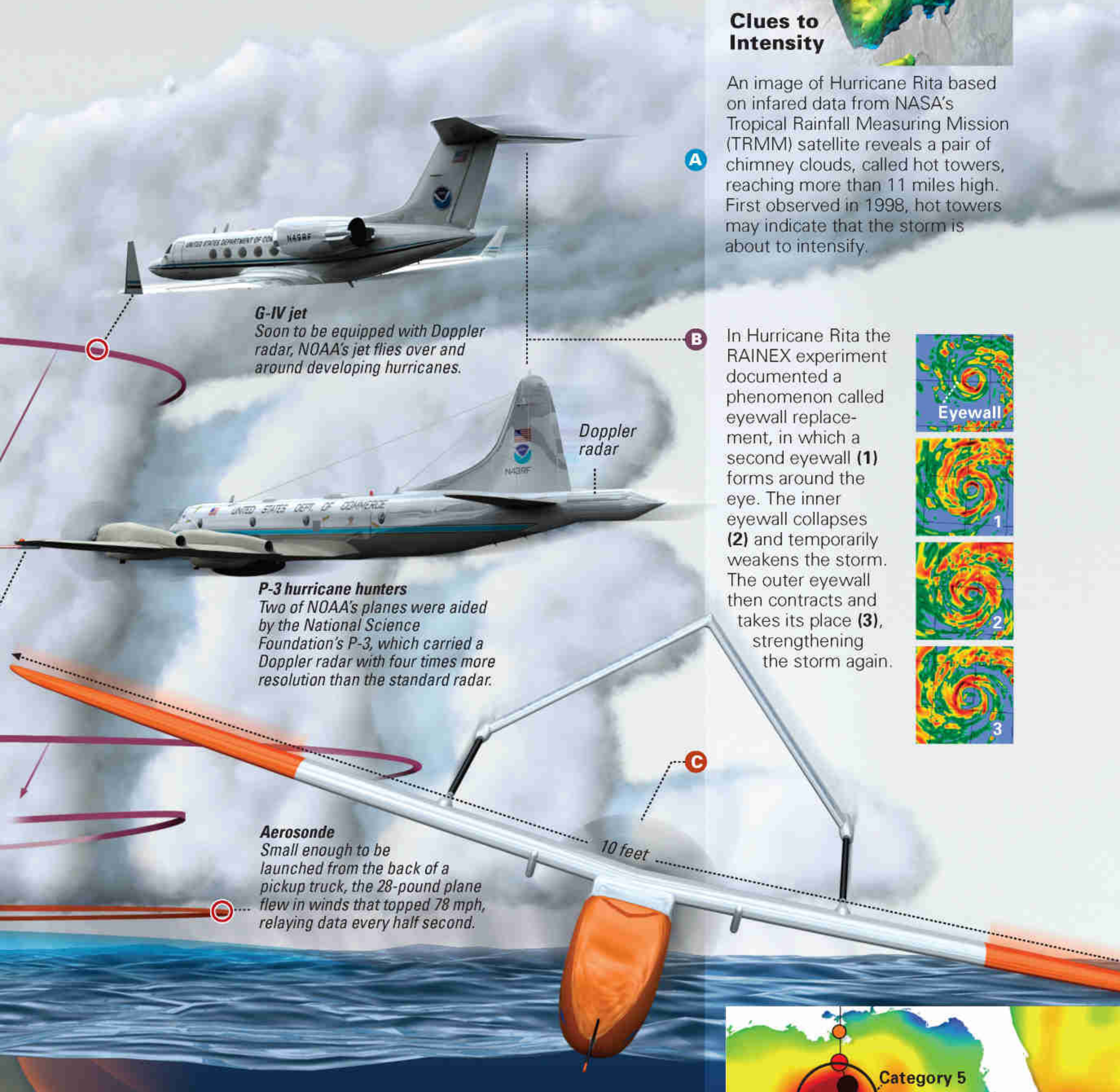
**A**

In Hurricane Rita the RAINEX experiment documented a phenomenon called eyewall replacement, in which a second eyewall (1) forms around the eye. The inner eyewall collapses (2) and temporarily weakens the storm. The outer eyewall then contracts and takes its place (3), strengthening the storm again.



**C**

**D**

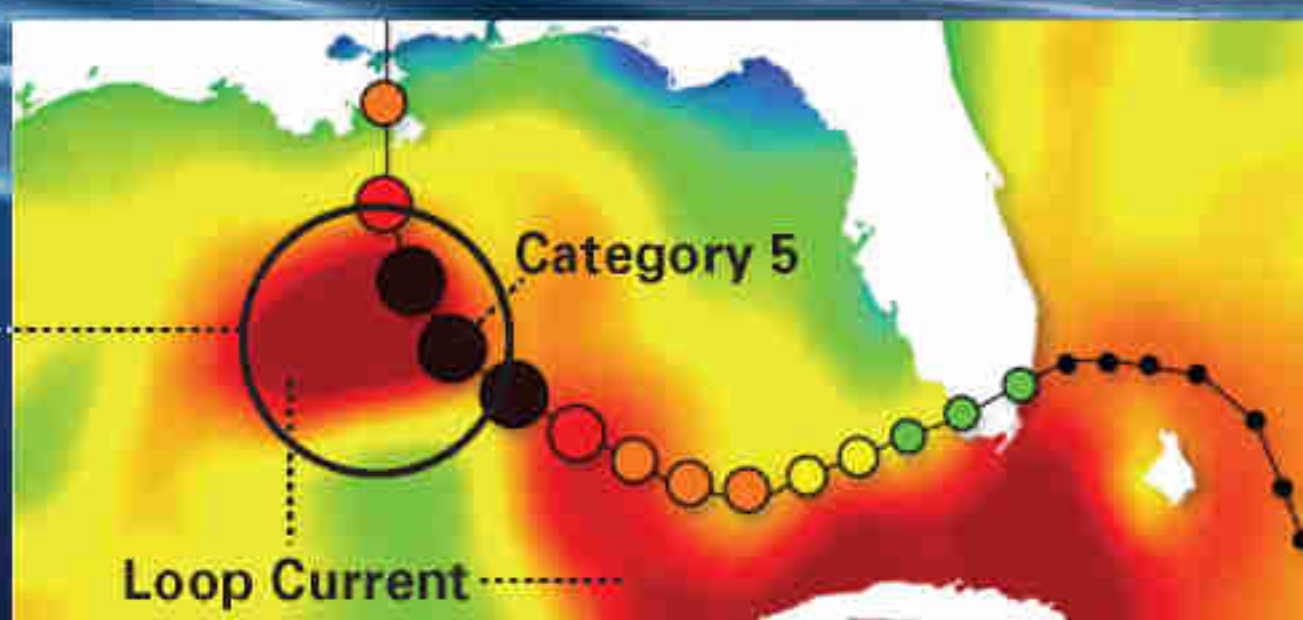


**G-IV jet**  
Soon to be equipped with Doppler radar, NOAA's jet flies over and around developing hurricanes.

Doppler radar

**P-3 hurricane hunters**  
Two of NOAA's planes were aided by the National Science Foundation's P-3, which carried a Doppler radar with four times more resolution than the standard radar.

**Aerosonde**  
Small enough to be launched from the back of a pickup truck, the 28-pound plane flew in winds that topped 78 mph, relaying data every half second.



An image of the Loop Current three days before Katrina's landfall shows how the storm intensified as it traveled over warmer waters (red).

SOURCES: PETER BLACK AND JOSEPH CIGONE, NOAA ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORY; SHUYI CHEN AND NICK SHAY, ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE

IMAGES: NASA GODDARD SPACE FLIGHT CENTER SCIENTIFIC VISUALIZATION STUDIO (TOP), ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE (MIDDLE AND BOTTOM)

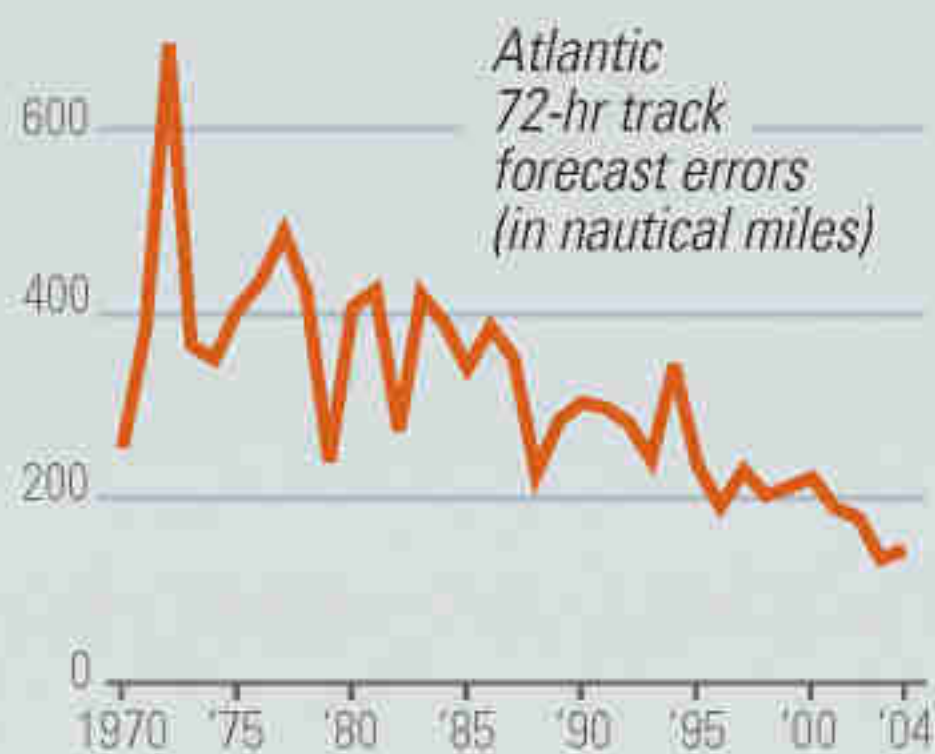
REPORTING BY BRENNAN MALONEY, DESIGNED BY JUAN VELASCO; ILLUSTRATIONS BY ROBERT KINKAID AND RAYMOND WONG



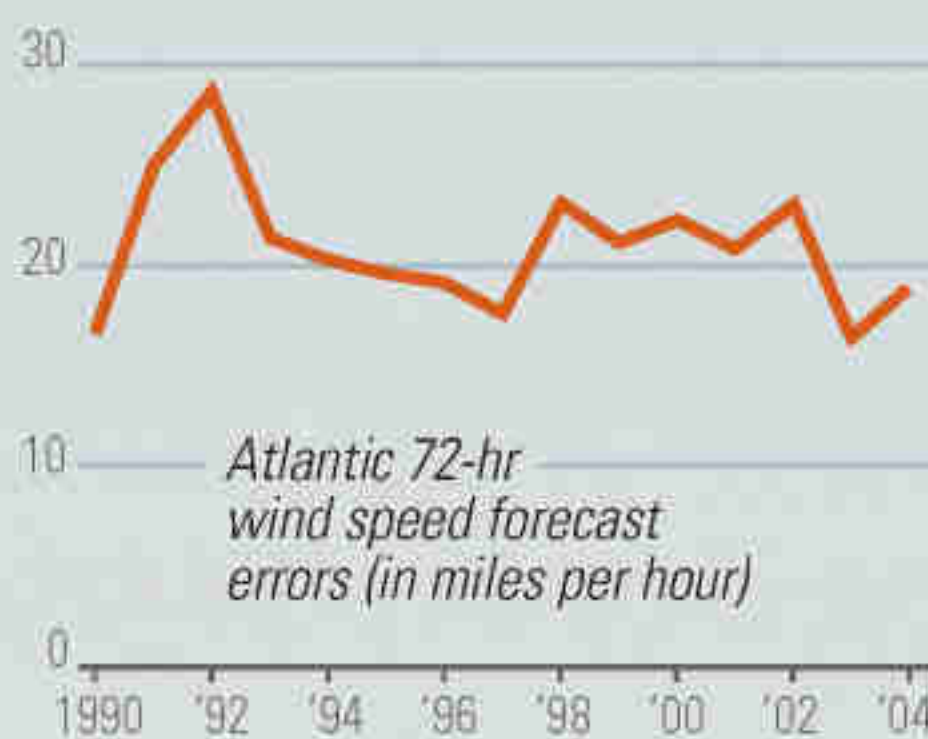
# Improving Forecasts

Better forecasts of hurricane tracks and intensity could reduce deaths and property damage by enabling officials to issue more timely and accurate warnings and evacuation orders. Total damages in the U.S. for the 2005 Atlantic season alone came to more than one hundred billion dollars, with the loss of at least 1,000 lives.

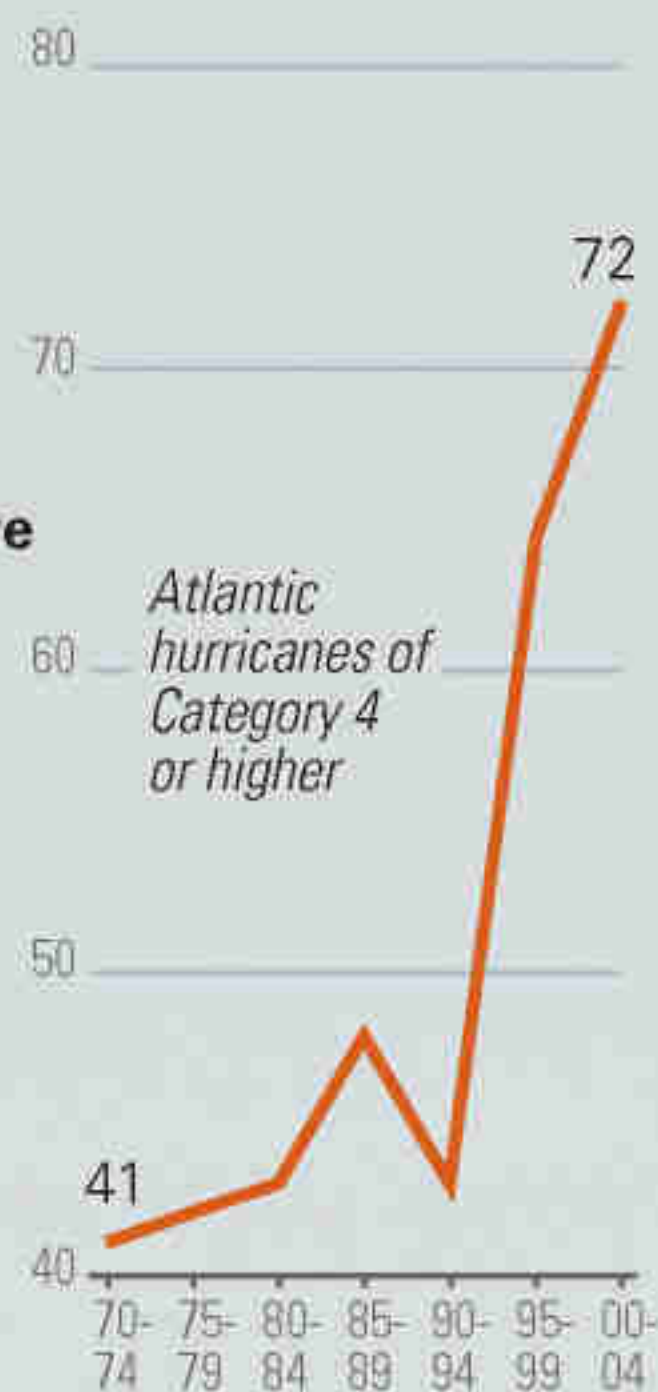
While track forecasts have improved substantially ...



intensity forecasts have not...



in a time when severe hurricanes are more frequent in the Atlantic.



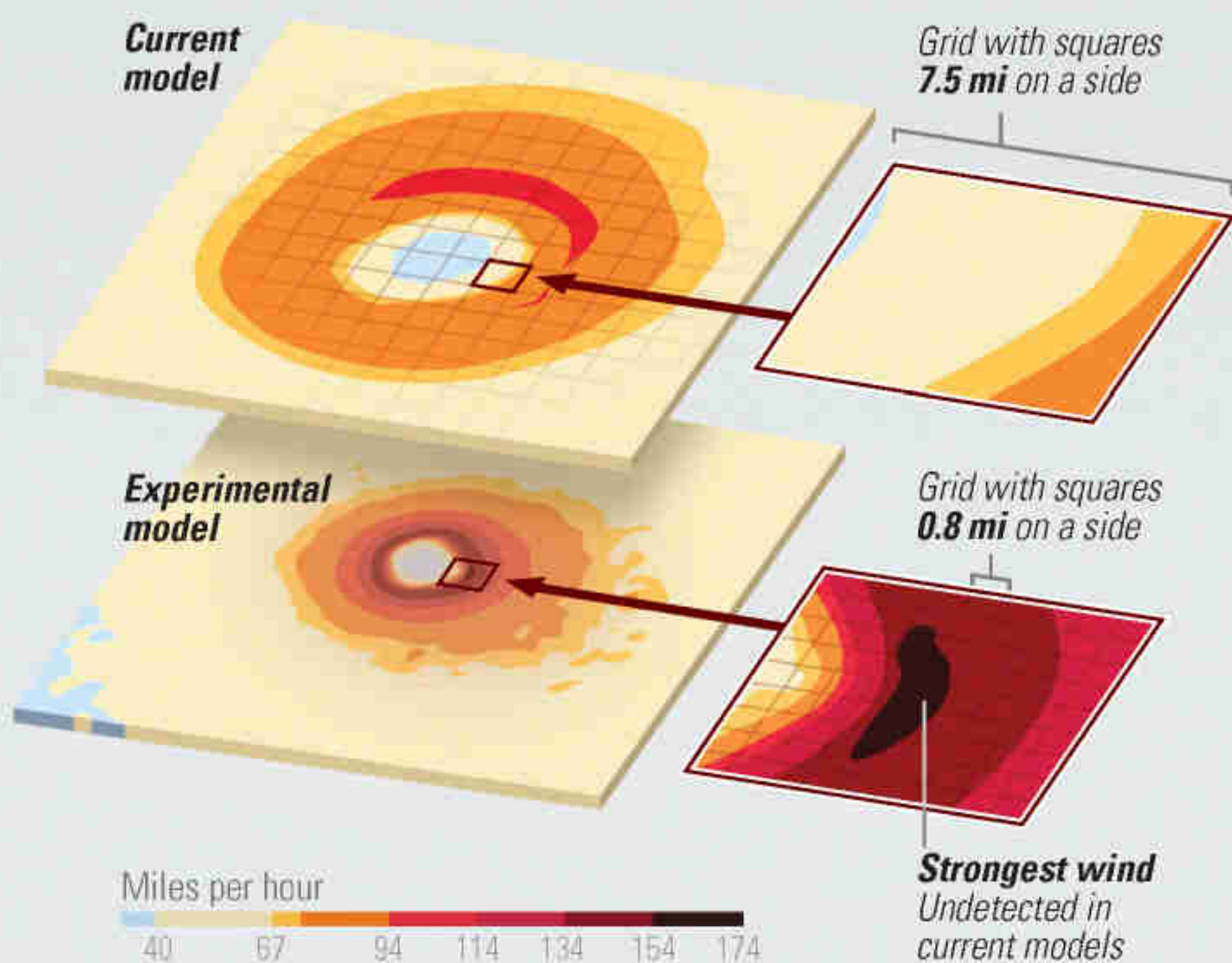
## Building Better Models

Computer forecasting models break storms into a grid and use sophisticated methods to calculate the changes in wind speed, humidity, temperature, and clouds. Current NOAA models are too coarse to zero in on the features that determine where the greatest damage might occur. In 2007, the new high-resolution NOAA Hurricane Weather Research and Forecasting (HWRF) model will become operational.

### A clearer picture

Below are forecasts of wind speed for Hurricane Katrina for the morning of August 28, 2005, when it intensified to Category 5. The current model runs at a 7.5-mile resolution; HWRF will run at a 0.8-mile resolution. Researchers are experimenting with even higher resolution models (bottom). The finer grid captures critical features that the older models overlook.

WIND SPEED FORECASTS FOR HURRICANE KATRINA



### A fuller picture

Accurate forecasts of a storm's track and intensity require the best possible picture of the ocean and atmosphere. Unlike current models, HWRF will rely on real-time wave, ocean, and coastal data to improve forecasts.



SOURCES: GREG HOLLAND, NATIONAL CENTER FOR ATMOSPHERIC RESEARCH; NAOMI SURGI, NOAA ENVIRONMENTAL MODELING CENTER; JAMES FRANKLIN, NOAA TROPICAL PREDICTION CENTER; PETER WEBSTER, GEORGIA INSTITUTE OF TECHNOLOGY; SHUYI CHEN, ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE



# Better science is the only way to get people to trust the warnings.

—SHARAN MAJUMDAR, ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE

intensity when the winds churn it to the surface. But Opal had strayed across a pool of warm water extending hundreds of feet down. No matter how hard the wind blew, it stirred up more hurricane fuel, causing the storm to intensify.

The tropical ocean is littered with these deep warm pockets, and their importance was underscored last year by both Katrina and Rita, which shot up to Category 5 when they passed over a deep band of warm Gulf water called the Loop Current. Satellites can detect subsurface warmth by looking for subtle bulges in the sea surface, Shay says. “It’s not really rocket science, but here’s something that works and improves intensity forecasts by 5 to 15 percent.”

Waves, on the other hand, can blunt a storm. Whipped up by a hurricane, they can reach heights of more than a hundred feet, exerting a drag on the winds that created them. “Heat adds fuel, but waves slow the winds down—they’re fighting each other,” says Shuyi Chen of the Rosenstiel School, who is collaborating on a powerful new computer model, called the Hurricane Weather and Research Forecasting model, that will simulate the fine details of the interplay between atmosphere, waves, and ocean. “You can get a forecast one to two categories wrong if you don’t get the waves right.”

Forecasters also need to understand a hurricane’s internal workings. Katrina, for example, had grown into a certifiable monster by the morning of Sunday, August 28. Sucking energy from the Loop Current, the storm had screamed from the low end of Category 3 to a peak of 175 miles per hour, well into Category 5, in just 12 hours. As Katrina barreled toward land, the NHC issued an apocalyptic warning: “POTENTIALLY CATASTROPHIC HURRICANE KATRINA MENACING THE NORTHERN GULF COAST.”

And then, swiftly and remarkably, the storm took a breather. In satellite images late Sunday, hours before landfall, a huge bite appeared in the southern side of the eyewall. Scientists probing the storm with aircraft and radar in a project called RAINEX worked out what had happened. Katrina’s ferocious rain bands had converged

toward the heart of the storm, cutting off the eyewall’s moisture supply. The old eyewall broke up and a new one formed farther out—an inertial brake that slowed the storm just as a skater’s arms slow her spin when she thrusts them outward.

If Katrina had been moving just a little faster, it could have hit land as a Category 5 horror. Instead, thanks to the timing of its eyewall replacement, it sideswiped New Orleans as a milder—but still devastating—Category 3.

**F**or a hurricane, landfall is a death sentence. Once its watery fuel supply has been cut off, the storm inevitably weakens. But that is scant solace to those caught up in its death throes.

From a washed-out stretch of Highway 90 along the Mississippi coast, almost four months after Katrina, the view inland took your breath away. The once lush coastline was still a litter of debris and splintered wood, houses swept from their concrete slabs, ancient spreading oaks stripped of Spanish moss and festooned with rags and tattered plastic.

Water was the primary agent of destruction here. Most hurricane casualties come not from wind but from rain, waves, and, as the scene here made harshly evident, surge—the vast mound of seawater that is pushed in front of the storm, rising 28 feet or more in the case of Katrina.

“If you really want to wallop something,” says Rick Luettich, a coastal oceanographer at the University of North Carolina at Chapel Hill, “Mississippi and Alabama are pretty close to ideal for maximum storm surge.” The coastal waters are shallow, easily plowed up by intruding winds. Local features matter too, says Luettich, who has worked on a computer program that forecasts surge height. Bays and estuaries can funnel and intensify surge, for example, while barrier islands and wetlands can buffer it.

Coastal development weakens those defenses, as a flight over an adjacent stretch of coast in Louisiana makes clear. Channels crisscross the marshlands, dredged for boat traffic. They let salt water into the back marshes, killing vegetation



# “We’re 11 years into the cycle. I can’t tell you

that holds them together. Add all the dikes and levees that hem in the Mississippi, cutting off the sediment that once replenished the marshes, and the result is staggering: More than 20 percent of Louisiana’s coastal wetlands reverted to open water from the 1950s through 2000, 27 square miles every year. The pilot holds up his chart of the tattered coast. “This here is the newest edition,” he says. “But it’s already out of date.”

The full impact of a giant hurricane can’t be measured in categories and wind speeds, in damage to homes and ecosystems, or even in lives lost. Those who live through one are never quite the same afterward. Tammy VanderZyl was a manager at Remoulade restaurant in New Orleans. She weathered Katrina in her apartment, then lived on the edge for three weeks with a group of near strangers. “You see things you never thought you would see,” she recalls. “I saw whitecaps in my parking lot.”

In his recent book, *Divine Wind*, Kerry Emanuel, a meteorologist at the Massachusetts Institute of Technology, intersperses the science and lore of hurricanes with paintings, poems, and literary excerpts inspired by the great storms of history. None is more poignant than the haiku VanderZyl composed after confronting Katrina:

*Strong wind blows away  
Everything that I am  
Where do I go now*

For VanderZyl and many of her fellow New Orleanians, the answer to the final line is obvious: right back home. The city will be different now. But leave? “No way,” she says. “Things would have to get way worse than this.”

**J**ust over the horizon of scientific certainty lies the disturbing possibility that they might. Kerry Emanuel is by all accounts a cautious scientist. For years he believed there was no good evidence that global warming was making hurricanes any stronger. But last year new calculations stopped him in his tracks. When he looked at the total power of tropical cyclones worldwide, he was faced with the conclusion that during the past three decades, the

## Paradise Lost

The remains of an oceanfront house now stand in the ocean off Dauphin Island, Alabama. More frequent and ferocious storms have made low-lying barrier islands ever more vulnerable. “There are places I wouldn’t pitch a pup tent,” Abby Sallenger of the USGS says.

storms have grown almost twice as destructive.

Emanuel’s results, published weeks before Katrina, were soon joined by another study, led by Peter Webster of the Georgia Institute of Technology. Webster concluded that the strongest storms—Categories 4 and 5—have become nearly twice as common over 35 years. The likely culprit, both scientists say, is global warming, which is adding hurricane-nurturing heat to the oceans.

It would be easier to find a building undamaged by Katrina in New Orleans’ Ninth Ward than to locate a reputable climate scientist who doubts that human activity is warming the Earth. But the claim that hurricanes are growing stronger as a result has set off a tempest of its own. William Gray of Colorado State University, a pioneer hurricane forecaster, has called it “plain wrong.” He and the NHC’s Christopher Landsea say Emanuel and Webster’s statistics are fuzzy and that data on past storms can’t be trusted. Until weather satellites became common in the 1970s, many tropical storms at sea went unrecorded, and since then changes in sensing technology have made it difficult to compare hurricane strengths.

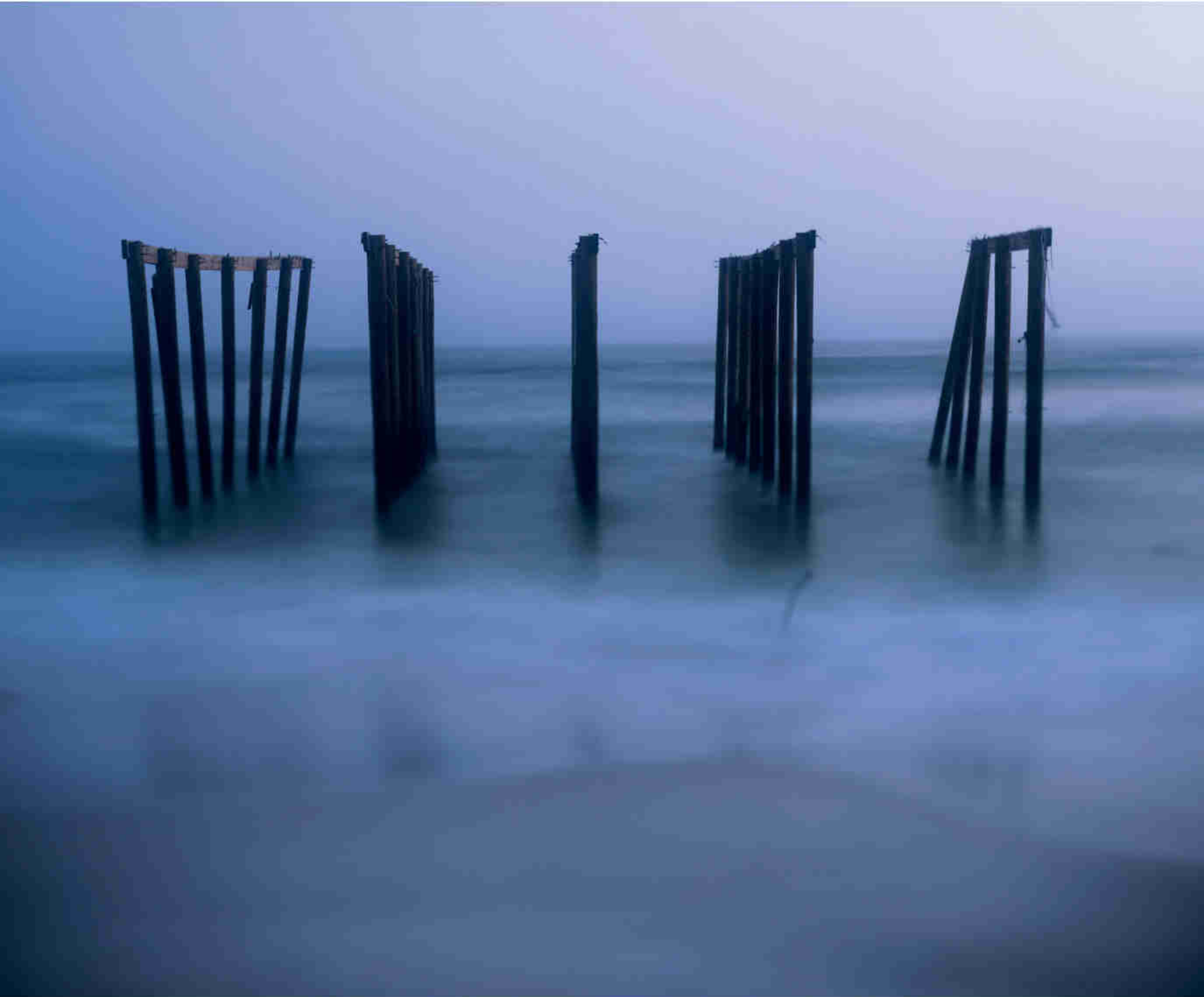
Emanuel agrees that the data aren’t perfect. “But this is an important issue,” he says, “and the only way to get a better answer would be to have a longer record of reliable data,” which would make any trends stand out.

To improve the record, Landsea has been analyzing hurricanes back to the mid-1800s, trying to gauge their intensity from accounts of storm surge and wind damage. Other researchers are looking for signs of past hurricanes at the bottom of coastal lakes, where the strongest



if it will last another ten years, or thirty.”

—GERRY BELL, NOAA METEOROLOGIST



storms deposited layers of windblown beach sand, and in the wood of old trees from coastal forests. Rainwater from hurricanes is minutely lighter than regular rain, so a tree drenched by passing hurricanes preserves a subtle record of each storm in its growth rings.

While the debates go on, hurricanes will continue to strike increasingly populous coasts. That, says Landsea, is reason enough to worry. “The changes in society are as important, if not more

important than global warming, or even natural cycles,” he says. “When you double some vulnerable populations every 20 to 30 years, that’s what’s going to cause disasters. We’ve got a huge problem even if hurricanes don’t change at all.” □

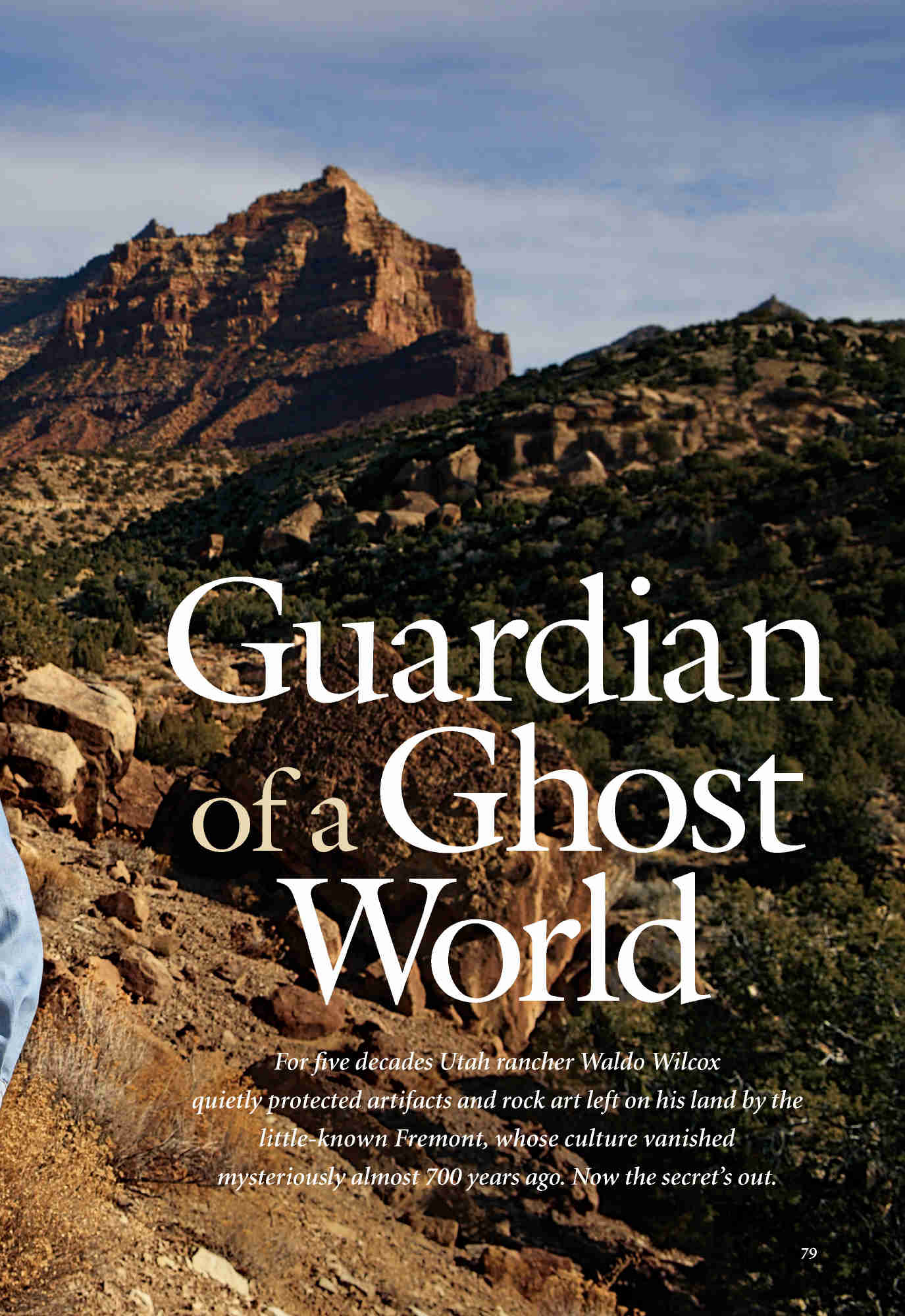
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**Hurricane Fury** Have you ever lived through a hurricane? How did it affect you? Share your stories in our online forum and post your thoughts on hurricane assistance at [ngm.com/0608](http://ngm.com/0608).









# Guardian of a Ghost World

*For five decades Utah rancher Waldo Wilcox quietly protected artifacts and rock art left on his land by the little-known Fremont, whose culture vanished mysteriously almost 700 years ago. Now the secret's out.*



BY DAVID ROBERTS

PHOTOGRAPHS BY IRA BLOCK

**W**ALDO WILCOX stayed on his father's Utah homestead in Range Creek for 50 years, even as he married and had four kids, and during that half century, the man performed a truly extraordinary feat.

As soon as the Wilcoxes had moved to Range Creek in 1951, they built sturdy fences with locked gates at either end of their prime cattle-raising spread, which stretched 12 miles along a remote canyon floor. As a grown man, Waldo regularly patrolled his valley—with shotgun in hand, rumor has it—to keep out trespassers.

In 2001, at the age of 71, he sold his ranch to the Trust for Public Lands. Waldo's wife had never much liked her remote home, and he had seen no way to divide the ranch fairly among his grown children. With heavy heart, Waldo moved into a boxy little house in nearby Green River.

The next summer, archaeologists got their first look at Range Creek. They were overwhelmed by what they found: arrowheads, potsherds, beads, grinding stones, rock art, granaries on high ledges, and rings of stones, the remnants of buried pit houses—all this, the work of the Fremont, farmers and hunter-gatherers who had lived there a thousand years ago and more.

Unlike many ranchers in the American West, for whom collecting prehistoric treasure was a customary hobby, Waldo had left virtually every artifact undisturbed. "I won't lie to you," Waldo says. "I picked up arrowheads, 'cause if I didn't, somebody else would. But I never dug anything up. Maybe I'm superstitious, but I figured them Indians wanted the stuff left there." About human remains, the rancher was particularly circumspect: "I don't want some damned hippie digging up my body after I die."

Last year at a meeting in Salt Lake City, Kevin Jones, the official Utah state archaeologist, said Range Creek was the best protected area he'd ever seen. "And the great irony," he said, "is that it was protected by a single private owner, not by all the laws that we've passed to preserve our cultural heritage."

Because of the canyon's riches Range Creek was kept secret for three years after Waldo sold it. But when a local newspaper leaked the story in 2004, a nasty controversy erupted. Powerful lobbyists for sportsmen's groups that had helped raise the money to buy the ranch insisted the canyon, now owned by the state of Utah, remain open to big-game hunting and trout fishing. Some even recommended clearing piñon and juniper trees to improve the reserve for wildlife. Native Americans were furious that the archaeologists had been invited into Range Creek before they knew of it. In the end, a number of tribes claimed ancestral affiliation, sight unseen, with the canyon, and Native American spokesmen demanded they be consulted about its future.

As of 2006, the future of Range Creek is still up in the air.


**FROM THE START**, the archaeologists enlisted Waldo as their guide to the often well-hidden Fremont sites. One spring day last year, as she walked the valley-bottom dirt road in Range Creek, team co-leader Renee Barlow, of the Utah Museum of Natural History, was bursting with pride: "So far we've found 280 sites, ranging from ruins and rock art panels to scatters of potsherds and toolmaking debris. Every one Waldo either told us about, or we found it on the way to a site he told us about. And we've only seen 15 percent of the canyon!"

"You ain't seen 5 percent, kiddo," Waldo rejoined.

Waldo's partnership with the researchers has a certain edge, for he takes a dim view of professional archaeology—and not without reason. Years ago, at a ruin a good thousand feet above the valley floor, Waldo had found an eroding Fremont skeleton sticking skull-first out of the earth. To protect it, he picked up a nearby metate—or "corn grinder," as he calls the stone basin the ancients used to pulverize their maize—and laid it over the skull.

Four years ago, Waldo directed a pair of archaeology students to the site. They came back



A close-up photograph of a sandstone cliff face. The rock is a warm, golden-brown color with visible horizontal and vertical cracks. A pecked rock art figure is visible, appearing as a light-colored, somewhat rectangular shape with some internal markings. The lighting is dramatic, highlighting the texture of the rock and the details of the pecked figure.

*Pecked into a sandstone cliff, a costumed figure—perhaps linked to a ritual—stands near a cluster of ancient houses and granaries found near the Wilcox ranch in Range Creek Canyon. Wilcox sold his land in 2001. Since then, archaeologists have surveyed only a fraction of the property but have already recorded more than 350 sites. Most belonged to the Fremont, named for a river 75 miles south where similar ruins were found in the late 1920s.*





from the all-day hike exhausted but exhilarated. “They told me, ‘We’ve discovered that the Fremont buried their dead with corn grinders covering their heads,’” Waldo recounted. “I said, ‘Yep, and I bet I can tell you right where that was, too.’”

Waldo gradually developed his own theories about the ancients who once thronged Range Creek. One evening, in the cinder-block house he had built for his family that now serves as the cluttered headquarters for the archaeologists, the rancher unfurled his ideas, based on the rock art and artifacts he had found.

“The first people in here wasn’t but four foot tall,” he said. “I call ’em the Little People. I think the Fremont come in and killed off the Little People. Then later the Utes come in and killed off the Fremont. Every place you find an arrow-head, there was a dead Indian.”

Project leader Duncan Metcalfe, of the University of Utah, absorbed this narrative from an adjoining chair. He kept a straight face, but professional dismissal oozed from his pores. Metcalfe and the other archae-

ologists had found little evidence of any prehistoric inhabitants other than the Fremont. And no professional would give credence to Waldo’s Little People.

Waldo perceived the dismissal. “I may not know what I’m talkin’ about,” he said later, “but hell, them archaeologists don’t know either. They’re just guessin’.”

One of the first to guess was Noel Morss, an amateur archaeologist who named the Fremont in 1931, after digging sites in central Utah on the Fremont River. More than 70 years later, experts still struggle to come up with a list of distinctive cultural traits to differentiate the Fremont from

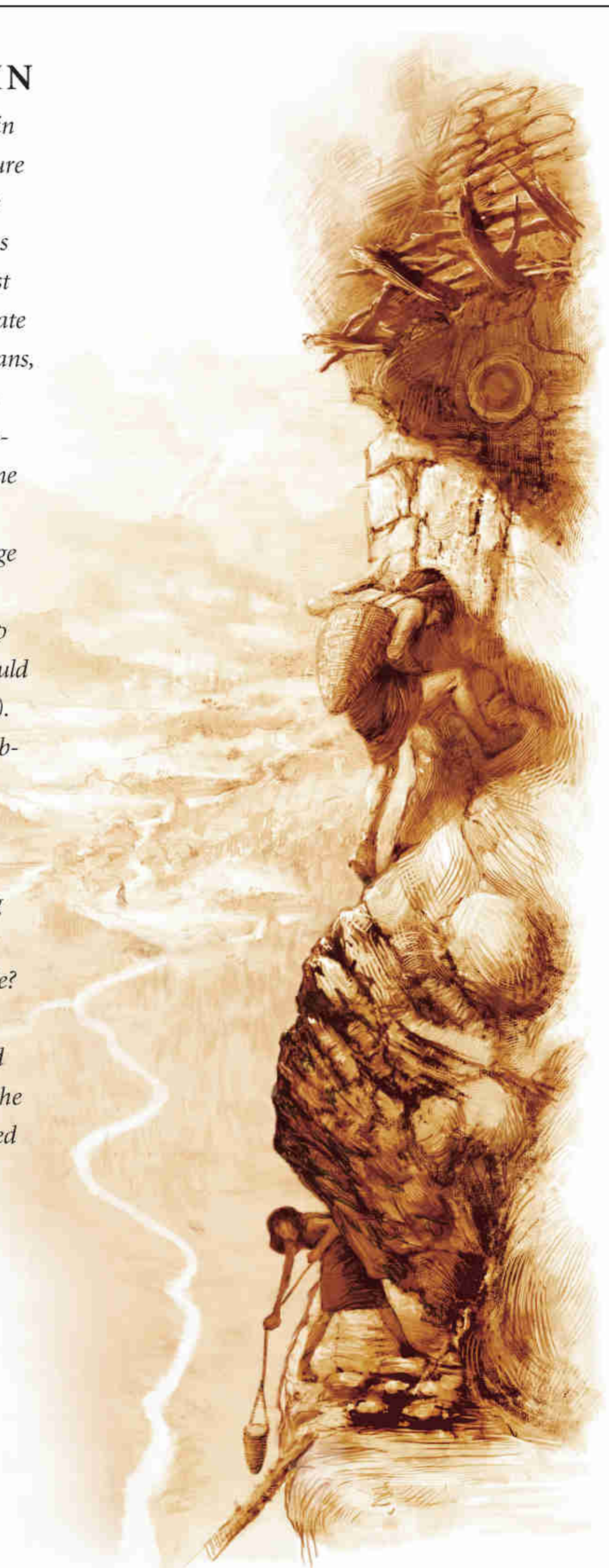
their contemporaries to the south, the Anasazi. They know, for instance, that the Fremont created sophisticated rock art, leather moccasins rather than yucca sandals, and a particular kind of thin-walled gray pottery. These scholars believe that the Fremont homeland reached from Utah into Nevada, Idaho, Wyoming, and Colorado. Dwelling on the edge of the reliable (Continued on page 89)





## EXTREME TERRAIN

*Living off the land was never easy in the region where the Fremont culture arose before A.D. 400—now most of Utah and parts of nearby states (map, below left). Even in the best of times, when the harsh, dry climate allowed the cultivation of corn, beans, and squash along waterways like Range Creek, the Fremont supplemented their diet by hunting game and gathering plants in the wild. During hard times they took refuge in villages on defensible spits of land and hauled their harvests up canyon walls to granaries that would be almost impossible to raid (right). Some must have fallen while climbing, a tragedy perhaps shown in a painting at Range Creek (left). The Fremont's aeries may attest to violent conflict. Did neighboring communities fight over scarce resources? Did a foreign group invade? Archaeologists hope the ruins at Range Creek—virtually untouched and unspoiled—will help reveal the Fremont's fate. Whatever happened to them, their culture had all but disappeared by 1350.*







*Distinctive artifacts found throughout Fremont territory characterize the culture that united these scattered farmers and foragers. Clay figurines—including this finely worked example from Range Creek (right)—display the broad shoulders and narrow waist often seen in rock art and likely had spiritual significance. Deerskin moccasins—like one discovered at Hogup Cave, Utah (left)—were probably everyday footwear. Fishing tackle (above) crafted from bone, wood, plant fiber, and pine resin was found in a basket in Mantle’s Cave, Colorado, along with hunting snares and a net bag—the tools of people accustomed to exploiting every available food source.*







*Strange figures that once conveyed a powerful message now stand as silent enigmas on a cliff face in central Utah. Experts can identify a dog with a curled, hairy tail, a six-foot-tall being holding a snake, and a trapezoidal creature painted over a bug-eyed form on its right—but they still can't decipher the meaning. They call this style of rock art Barrier Canyon and believe it was left by nomadic hunters and gatherers who may have been ancestors of the Fremont. Thousands of similar sites display paintings and petroglyphs from one or both of these cultures, and many show the harmful effects of time, weather, and vandalism. Here, parts of the cliff are spalling, or breaking away, taking the images with them. "Spalling is a big problem," says Constance Silver, a conservation specialist, "because we don't know what to do about it yet."*











## THOUGHTLESS DESTRUCTION

Whether malicious or simply misguided, modern humans have left their mark on Utah's ancient art. A figure near Temple Mountain (top) bears bullet holes as well as carved initials and a date, both common kinds of damage. Like many travelers in the late 1800s and early 1900s, someone recorded a trip to petroglyphs near Rochester Creek (above right); today such vandalism on public and Indian lands can result in a prison sentence, a fine, or an order to perform public service—if the perpetrator is caught. Decades ago a rancher stenciled a misspelled warning over a painted elk in Nine Mile Canyon (above left). “There was nothing illegal about it,” says archaeologist Jerry Spangler, “but it reflects the growing conflict between private landowners and tourists who traipse over their property without permission.” So far, the sites at the Wilcox ranch are unscarred. The question now is how to keep them that way.



(Continued from page 82) growing season, where late-spring or early-fall frosts all too often ruined a whole year's crops, the Fremont never fully committed to a farming way of life. Many kept hunting and gathering as a fallback option, always ready to pack up and move on.

By A.D. 1350, the Fremont had largely disappeared from their homeland. No one knows what became of them. Perhaps some migrated east to the Great Plains and assimilated with nomads who hunted bison. Others may have been wiped out by the Ute, Shoshone, and Paiute, who might have surged into the Fremont heartland from the west as early as the 13th century. Perhaps many Fremont simply starved to death.

THE MOST SIGNIFICANT ruins in Range Creek are all high, inaccessible sites, many of them granaries. Greg Child, an expert mountaineer, Renee Barlow, and I worked our way into ones that even Waldo hadn't reached, becoming almost certainly the first visitors in at least 700 years.

That the Fremont stored their grain on such severe cliffside ledges made perfect sense to Waldo. "It's like why you put your money in a bank," he said. "If you only got a little bit of corn, and everybody's hungry, you hide it away where other folks can't steal it."

The most extraordinary of all the sites we explored—nicknamed Waldo's Catwalk by Renee—was 60 feet up an overhanging 150-foot cliff. When we arrived at the base of the cliff, Greg said softly, "My mind is blown." We could see the route some Fremont daredevil had used to reach a ledge with two granaries. The Fremont climber had leaned a 25-foot-tall Douglas fir trunk against the cliff to shinny up. From the tip of this makeshift ladder, he had "gone for it" (in climbing parlance), using hand- and footholds to launch his body over two outjuts of rock that blocked his way like roof cornices on a building. Midway through that desperate passage, he had hung on with one hand while with the other he had slammed a hefty stick into a crack, then trusted it with all his weight as he pulled himself up on it before continuing his climb.

Greg estimated the route would rate 5.11 for modern climbers, on soft, crumbly sandstone—near the limit even for today's best rock jocks using nylon ropes, sticky-soled shoes, and cams and nuts for protection. We were not about to tackle it. Instead, Greg got us into the site from

the rim above by slotting spring-loaded cams into a crack, stitching a rappel tight to the overhang, then swinging sideways till he reached the ledge.

Some 50 years ago, Waldo had climbed to the base of this cliff, then stared up in wonder. But when I expressed astonishment at the Fremont acrobat, Waldo was less impressed. "Look at it this way," he said. "Them Indians did nothin' but climb every day. Maybe some of 'em fell off and died, but the ones that didn't got pretty darn good at it."

IN THE SUMMER of 2005, the tension between Waldo and the scientists who had taken over his erstwhile paradise began to mount. During their four seasons in Range Creek, the teams had plotted the GPS coordinates of every site they'd found and recorded the location of every potsherd, arrowhead, and metate. But they were also gathering up artifacts to take to the Utah Museum of Natural History. Waldo was dismayed. "I think they should leave the stuff where it is," he said. "The canyon's the biggest and best museum the Indian stuff could ever be in."

Waldo has nursed a sense of doom about the canyon he loved. The cattle he ran kept the valley grazed, but today the grass stands thigh-high, creating a tinderbox. It infuriates Waldo that the archaeology team—more than half of whom smoke—won't institute a site-wide smoking ban.

"The whole place is gonna burn down," Waldo said. "Ten years from now, when the canyon's ruined. . . ."

One May evening, Waldo and I sat on the lawn in front of the cinder-block house. Far above us to the north, a butte where Waldo had discovered a ruin caught the orange glow of sunset. The old man seemed in a pensive mood. "What does it feel like to come back?" I asked.

Waldo paused. "It hurts," he finally said. "I should've had my ass kicked for sellin' it. There's only one Range Creek in the world, and I let it slip through my fingers."

But then a certain gleam lit his gaze. "There's one other place I know of with as much Indian stuff in it as you got here," he said. "And if they ruin Range Creek, that secret's goin' with me to the grave." □

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**Outdoor Museum** Should artifacts be kept in situ or moved to museums? Share your thoughts in our forum at [ngm.com/0608](http://ngm.com/0608).



# Seasons of smoke

To the Cherokee these hills were *shaconage*—blue, the color of smoke. To more than nine million visitors a year, Great Smoky Mountains National Park offers sanctuary for the soul.





*Misty ridges unfurl near 6,000-foot peaks. Straddling the border between Tennessee and North Carolina, this is a park for all seasons, robed in a wealth of living things.*





*Pennsylvania sedge flows over Black Camp Gap in*





*June (above). Adrift in autumn, an oak leaf (left) floats down Big Creek at the park's northeastern edge.*







BY ADAM GOODHEART

PHOTOGRAPHS BY MICHAEL MELFORD

Surely these are, if nothing else, the most perfectly named mountains in the world. “Great Smoky Mountains”: The words conjure fog drifting off a breathing canopy of trees, mist rising above a waterfall, the soft warmth of southern air. Perhaps, as well, the tang of barbecue chased down with moonshine whiskey. But whoever may have coined that poetic phrase, his identity, or hers, is lost to history. Some say it harks back to the Cherokee word for blue—*shaconage*—for these ancient summits seem cloaked in the wood-smoke of a thousand vanished council fires.

When its boosters brag about the qualities of Great Smoky Mountains National Park, they mention both its wildness (“the last great virgin forest in the East”) and its proximity to civilization (“within a day’s drive of more than a third of the U.S. population”). It seems an impossible paradox, especially as you inch your way through Gatlinburg on Highway 441 toward the park’s busiest entrance, past an unbroken wall of motels, waffle houses, and T-shirt shops on either side. How could an area like this possibly contain some of the most verdant habitats and sublime mountain vistas in eastern North America?

Yet once inside the park itself—through which Highway 441 continues, but now as a kind of tunnel through lush foliage—it is clear that you have entered a different world. The park’s 814 square miles, stretching in an oblong mass across the Tennessee–North Carolina border, put it nearly on a scale with great western parks like Yosemite. But visitors who come in search of Ansel Adams landscapes may be disappointed. They will find no glaciers here, no geysers, no heart-stopping canyons. There are, wrote one early traveler, Horace Kephart, “no ribs and vertebrae of the earth exposed. Seldom does one see even a naked ledge of rock.”

Instead, these ancient, eroded mountains are covered by a living carpet of green. The vast wealth of the Smokies is in the

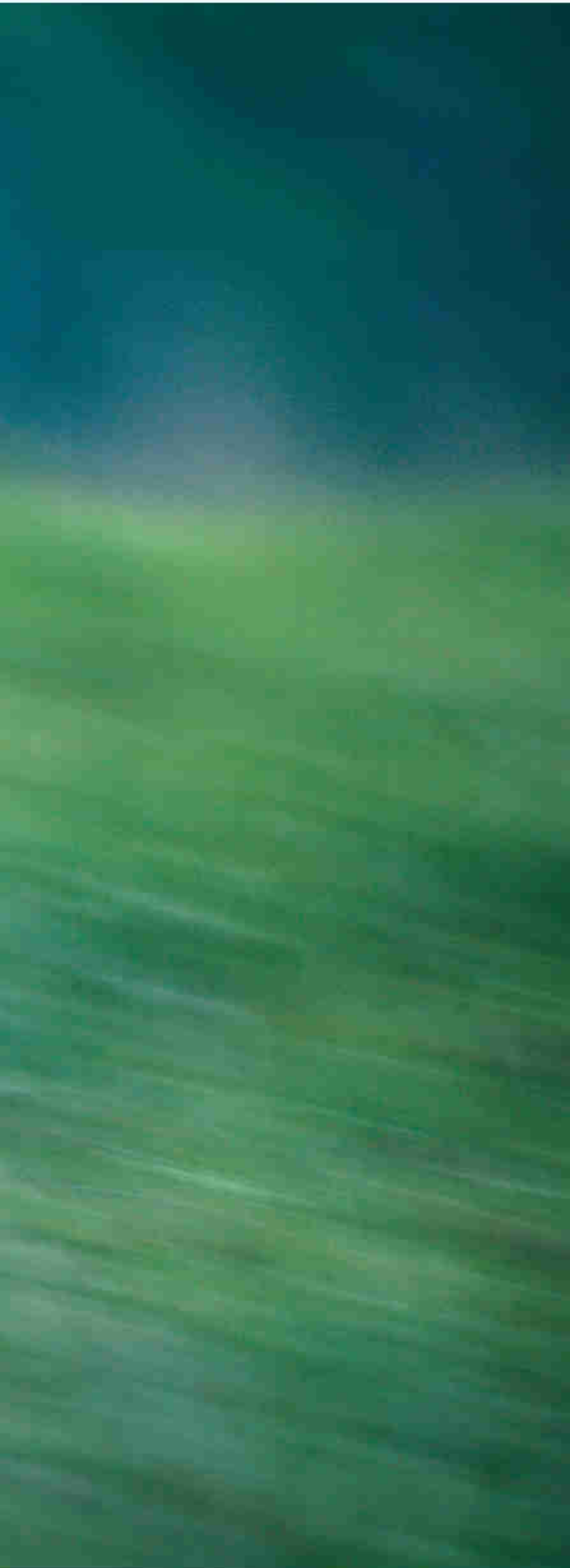
*A January storm paints a winter canvas near New-found Gap, buried by nearly 70 inches of snow each year.*





*A coyote flees with an apple pilfered from a visitor in 6,800-acre Cades Cove (map, right).*





region's profusion of animal and plant life—riches that have only recently begun to be fully appreciated. Since 1997, a coalition of scientists, naturalists, and citizen volunteers has undertaken a treasure hunt to identify and catalog every single species found in the park. The survey is the most ambitious and sustained effort of its kind ever conducted in North America.

So far the tally stands at 14,000 and counting—among them some 600 living organisms previously unknown to science, many of which probably exist nowhere else. Most of these are not what one would call “charismatic” species: They include snails, beetles, moths, and new types of algae. Still, scientists say the findings indicate a level of biodiversity rivaled by few other places on the planet outside the great tropical rain forests. And they believe that the Smokies’ ultimate species total may reach ten times the current count.

A conspiracy of factors made these mountains a near-perfect hothouse of biodiversity, according to Keith Langdon, one of the project’s coordinators. The north-south orientation of the Appalachian chain helped: During the last ice age, many species took refuge from the glaciers here, fleeing southward along protected valleys. The Smokies also have a diverse underlying geology, and a heavy annual rainfall fueled by tropical air from the Gulf of Mexico. Most important, dramatic changes in elevation mean that this relatively small region encompasses a stunning variety of ecosystems. “When you hike from the lowlands to the upcountry here, it’s like hiking from Georgia to Maine,” Langdon said.

In fact, for anyone who grew up somewhere in that long stretch of the United States, walking in these woods is like experiencing familiar landscapes that have been somehow enriched, enlivened,











*A sycamore spreads bare arms in late October, though fall colors usually peak in early November.*



concentrated. Meadows hum with bees, groves of hemlocks echo with the knock of woodpeckers, barred rays of sunlight shift and dance above the surface of a trout stream: It is as if a thousand well-loved meadows, a thousand groves, a thousand streams, had all been distilled into this mythic forest, this eastern Eden.

THANKS TO THEIR sheltered isolation, the Smokies are—or once were—a kind of cultural biosphere reserve, as well as an ecological one. One local person who is well aware of that is Mike Maples, whose European-American forebears began settling here in the late 1700s. “There’s not a place in the park where I’m not rich in cousins,” he boasted. Maples, an avid amateur historian, spoke in the present tense, but the truth is that all those kinfolk have been gone for decades, dispersed when the national park was created in the 1930s. Unlike most of the western parks, which were carved out of vast holdings of federal land, Great Smoky Mountains National Park was stitched together from thousands of small tracts, including farms and villages that had existed for a century or more.

This part of Appalachia was the ancestral home of the Cherokee and one of the first frontiers of the fledgling United States, where the restless energies of the young nation spilled over into a green new land. Tough Scotch-Irish veterans of the Revolution made their way, rifles in hand, along the chain of mountains. They and their descendants built communities in which old ways died hard, family feuds died even harder, and moonshining was a way of life. (Without decent roads, turning your corn crop into liquor was the only way to get it handily to market.)

Although the Park Service has preserved scores of scattered buildings, not much is left of many settlements but some gnarled fence posts in the woods, a few tumbled chimney stacks, and perhaps a small cemetery on a muddy hillside. There also remains a lingering resentment of the park among some local families who were forced to give up hard-won lands and livelihoods.

I met one of the last of the dispossessed, 96-year-old Gudger Palmer, at a reunion of families that once lived in the park’s



*White-tailed deer like this eight-point buck thrive in the park. In Cades Cove, 19th-century settlers planted the first gladiolus, which still bloom today (right). Since 1997, one of the most comprehensive biodiversity inventories ever conducted has logged 14,000 species of plants and animals in the park, and the count goes on.*





Cataloochee Valley. Palmer's great-grandfather, in the 1830s, cleared with his own hands fields that have now been made wilderness again. "I used to mow hay right here, with a horse-drawn mowing machine," Palmer said, pointing to a meadow where elk, reintroduced to the park several years ago, now roam. "There were about a thousand people in this valley, including children. It feels like home still. People didn't want to go, but we knew we had to."

Maples shares the sentiment but has also come to terms with the past. "My grandmother hated the park till her last day on Earth. But if it weren't for the park, what would all this be now? Nothing but condos and hotels, probably."

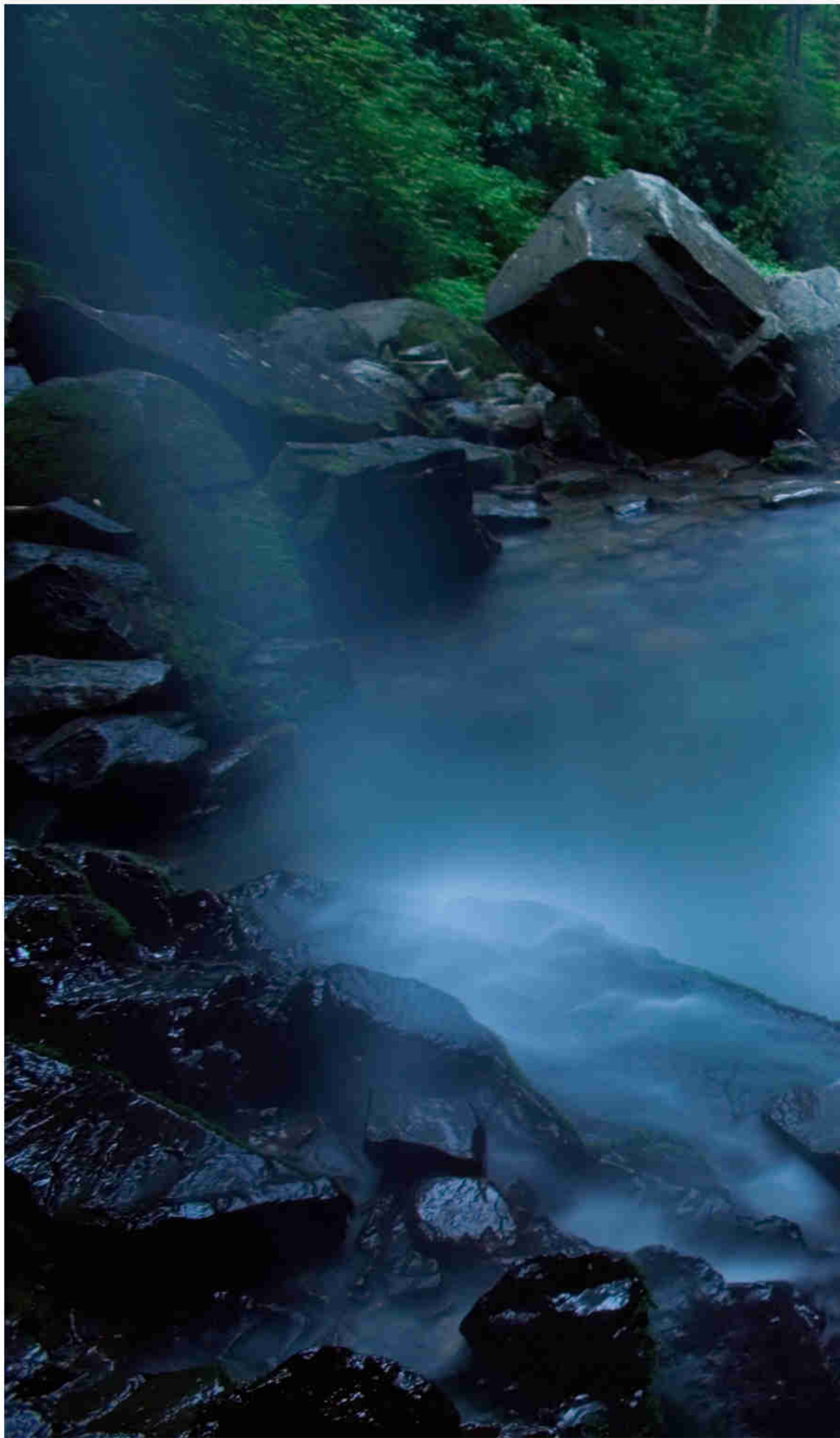
THE SMOKIES ARE, by some measures, the most visited national park in the country, yet the great majority of visitors never set foot on an unpaved surface. They may stop by the park visitors center or drive the scenic loop at Cades Cove—a grassy valley where cars crawl bumper to bumper as people lean out of win-

dows to photograph deer—but they never glimpse the backcountry trails, just a few miles away, where even on a summer weekend you can hike all day and encounter scarcely another living soul.

Great Smoky also suffers from some of the worst air pollution of any national park in the country, thanks not just to those cars but also to coal-burning power plants and factories throughout the eastern United States. When you hike a ridgeline on an overcast day, you may be inhaling rain clouds that have the approximate acidity of vinegar and ozone pollution that rivals nearby cities. Not surprisingly, many trees along those ridges are dead or dying, although the dirty air serves only to weaken them. The actual killers are exotic insects and other plagues. An invasive blight in the 1930s all but erased the mighty American chestnut. More recent invaders threaten the park's hemlocks, dogwoods, butternuts, beeches, spruces, and firs. "What will the forests look like 20 years from now? Probably very different," said backcountry manager George Minnigh.

Crisis and change are not new to these woods. One weekend





*A trail leads behind the veil of a waterfall along a swift stream called Roaring Fork.*







I hiked up Hazel Creek, the still-remote area where Horace Kephart camped a century ago. A writer and ethnographer, Kephart came to these mountains in 1904, drawn by his love of wilderness and of communities where he found the 18th century still living undisturbed in the 20th. “All about us was the forest primeval,” he wrote in his most famous book, *Our Southern Highlanders*, a vivid anecdotal account of life among moonshiners and mountain folk. “Our settlement was a mere slash in the vast woodland that encompassed it.”

Years later Kephart returned to the area to find it altered beyond recognition. “Industrial logging had come to Hazel Creek. They’d just raped it,” said my hiking companion Kenneth Wise, a librarian and Kephart aficionado. After the big lumber companies ramped up logging in the Smokies in the early 1900s, about 80 percent of the forest was clear-cut and turned into clapboard houses, newsprint, and World War I biplane struts.

Fighting to save what was left, Kephart became one of the earliest and most eloquent advocates for a national park in the Smokies. Today, robust second-growth forest covers the hillsides along Hazel Creek. Even that “mere slash” in the wilderness has vanished almost without a trace.

EVERYONE, INCLUDING THE MOST CASUAL VISITORS to the park—the ones just passing through on Highway 441 on their way to someplace else—stops to take a picture at Newfound Gap. It is the notch where the road crosses the ridgeline between North Carolina and Tennessee, and from the highest point there is a panoramic view of green peaks stretching row on row into the farthest distance. In the parking lot one summer afternoon, road-tripping parents and kids mingled with Chinese-speaking tourists and grizzled Appalachian Trail through-hikers.

Newfound Gap is also the spot where, on September 2, 1940, President Franklin D. Roosevelt gave a speech dedicating Great Smoky Mountains National Park. “FOR THE PERMANENT ENJOYMENT OF THE PEOPLE,” reads a plaque on the stone observation tower beneath which the President spoke. Those people included thousands of schoolchildren who donated pennies to help purchase the family farms of Gudger Palmer and others.

As I stood looking at the plaque and the green expanse beyond, it occurred to me that even more than other national parks, Great Smoky is not just a natural phenomenon but also a human, political one. The wilderness below me was, in a very real sense, man-made. And perhaps, in a crowded world, a place like this can offer hopeful clues to how we can continue coexisting with nature—or early warning signs of what we stand to lose. □

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**A Park for All Seasons** Bring the beauty of the Smokies to your desktop, explore a photo gallery, and get travel tips at [ngm.com/0608](http://ngm.com/0608).







*Catawba rhododendron petals carpet a trail up Brushy Mountain in June.*

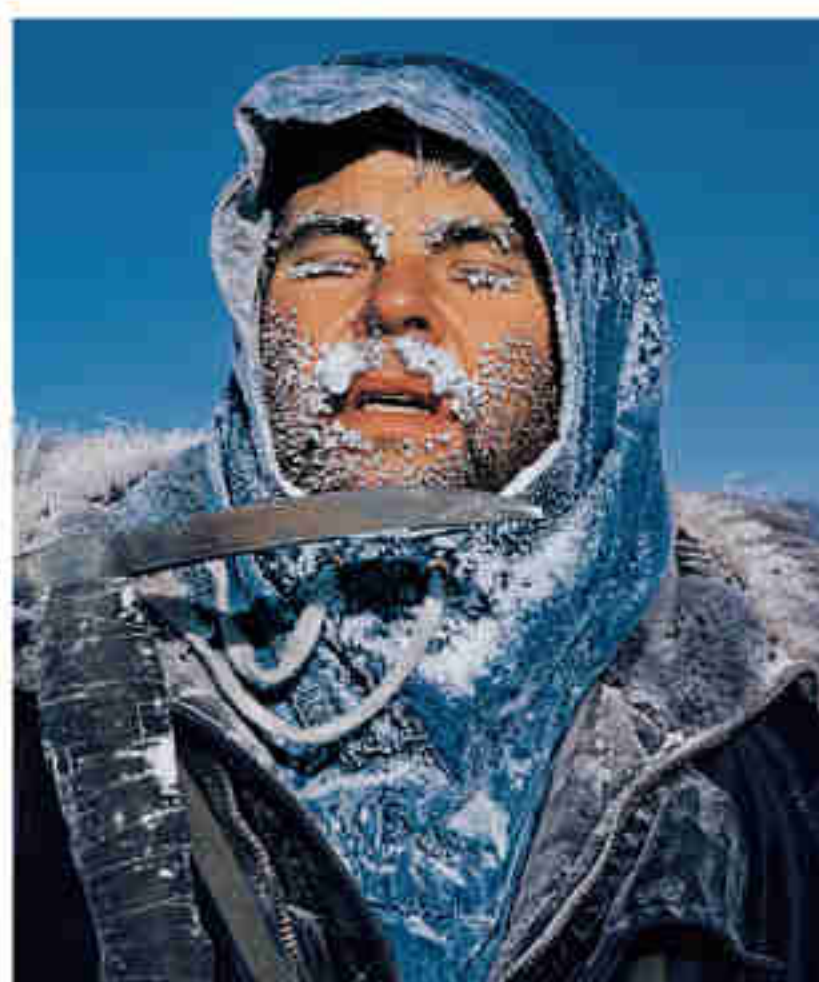






# T O M A B E R C R O M B I E

1930-2006



## A G E O G R A P H I C L I F E

*By Don Belt*

SENIOR EDITOR

Sixty years ago, a 15-year-old boy in Stillwater, Minnesota, accompanied his older brother to the town's Lumberjack Days parade. A pilot just back from World War II, the older brother, whose name was Bruce, brought along the Leica camera he'd purchased in Italy, and began taking pictures of the floats. His younger brother watched for a while, got bored, and wandered off in search of something more interesting. He noticed a boy on the curb, making faces at the girls on the floats. "Hey, Bruce," called the younger brother, "that's what you should be taking pictures of!" Later he borrowed his brother's Leica, made a drawing of it, and built a camera out of mirrors, a discarded lens, and scraps of plastic. His first photograph was of his girlfriend, Lynn.

Thus began the journalistic passion of Thomas J. Abercrombie, who died recently at age 75, after retiring in 1994 from a monumental NATIONAL GEOGRAPHIC career that took him to every continent, taught him four languages, brought him near death more times than he cared to count, and yielded 43 articles for this magazine, including some of the most ambitious ever published. During his 38 years on the staff, Abercrombie reported as a writer and photographer from



*He liked being married. In the Empty Quarter of Arabia, Tom and Lynn were traveling together when a local sheikh decided to claim Lynn, a tall, striking brunette he assumed to be Tom's daughter, as wife number four. He offered 30 camels for her. Tom countered with 50.*



*Lynn and Tom's wedding, 1952*



*Tom gearing up for Saudi Arabia, 1965*

Japan and Cambodia, Tibet and Venezuela, Spain and Australia, Alaska and Brazil, and as the first photojournalist ever from the South Pole. But his most significant and enduring contribution surely lies in the 16 articles he produced on the Muslim world between 1956 and 1994, which guided *GEOGRAPHIC*'s readers through the glorious and tangled geography of what may be, now as then, the closest thing the Western world has to terra incognita.

Abercrombie came to the Society in 1956, after a brief stint in the Army (scuttled by a foot fungus, which he'd picked up lifeguarding) and work as a photographer for two mid-western newspapers, the *Fargo Forum* and the *Milwaukee Journal*. Hard news coverage earned him Newspaper Photographer of the Year honors at the *Journal*, but it was a picture of a backyard bird—a robin tugging at a worm—that won the heart of *GEOGRAPHIC*'s Melville Bell Grosvenor, who said the picture could only have been taken by another robin. Abercrombie flunked his *GEOGRAPHIC* physical—those feet again—but Editorial overruled Medical, and Tom was hired.

He had never traveled outside the United States, but on his first overseas assignment, to Lebanon, he found that a short, gruff, good-natured man from Minnesota could strike up a conversation with just about anybody. He

interviewed Lebanon's president, Camille Chamoun, and made the notoriously stiff Chamoun so comfortable that he invited Tom to photograph him and his wife sprawled under a tree. And in a Lebanese town, Qabb Ilyas, he made his first visit to a mosque, an epiphany of sorts that he later described in the article: "After the service I mingled with the people, drifting with the human current out the door past a long line of beggars and down the narrow street. Walking and talking with them, I had a warm feeling of belonging; they seemed to accept me as one of their own."

That moment, or something like it, played out thousands of times during Tom Abercrombie's career, which brought him into close and welcome contact with the people of more than 80 nations. He often likened himself to a one-man army when he set off into the field—in a customized Land Rover with metal gas cans lashed to the roof, a dozen or more hard cases, water jugs, sleeping bags, books, duct tape, baling wire, topographic maps, shrink-wrapped rations, mounds of pipe tobacco, and, depending on local circumstances, a firearm or two—but humanity was his secret weapon.

"Abercrombie was tough as nails, but he was incredibly gentle with people," says retired *GEOGRAPHIC* photographer Jim Stanfield, who traveled the Sahara with Tom in a 400-camel





*Tom's photograph from Fiji, 1973*





Tom's photograph from Ladakh, 1977

caravan. "He was a world-class listener. He'd spend hours talking to some guy in a coffee shop, smoking his pipe and yakking about this and that. He had a great mind, and infinite curiosity. He took his time with people, and they trusted him. Even when he didn't speak their language, he always found a way to connect."

In eastern Afghanistan, for example, he fell in with a group of men playing *buzkashi*, the traditional Afghan sport of galloping horses, calf carcasses, and bloody, horse-to-horse combat. "The way I got chummy with the players, who are not a real chummy bunch, was that I was photographing and a horse chewed one of these guy's ears right off," Abercrombie, who cursed like a sailor, told a reporter in 1998. "I had this hell of a first aid kit I carried around. I had damn near a hospital, this huge fishing tackle box full of morphine and sharpened scalpels. So I fixed this guy's ear up and made him feel a little better."

Abercrombie's medical exploits were legendary. There was the amputation, with a pocketknife, of a pilgrim's gangrenous toes in Tibet, his emergency care of survivors after an earthquake in Iran, his one-man triage and field surgery after a speeding truck piled high with passengers flipped over on a highway in Nigeria.

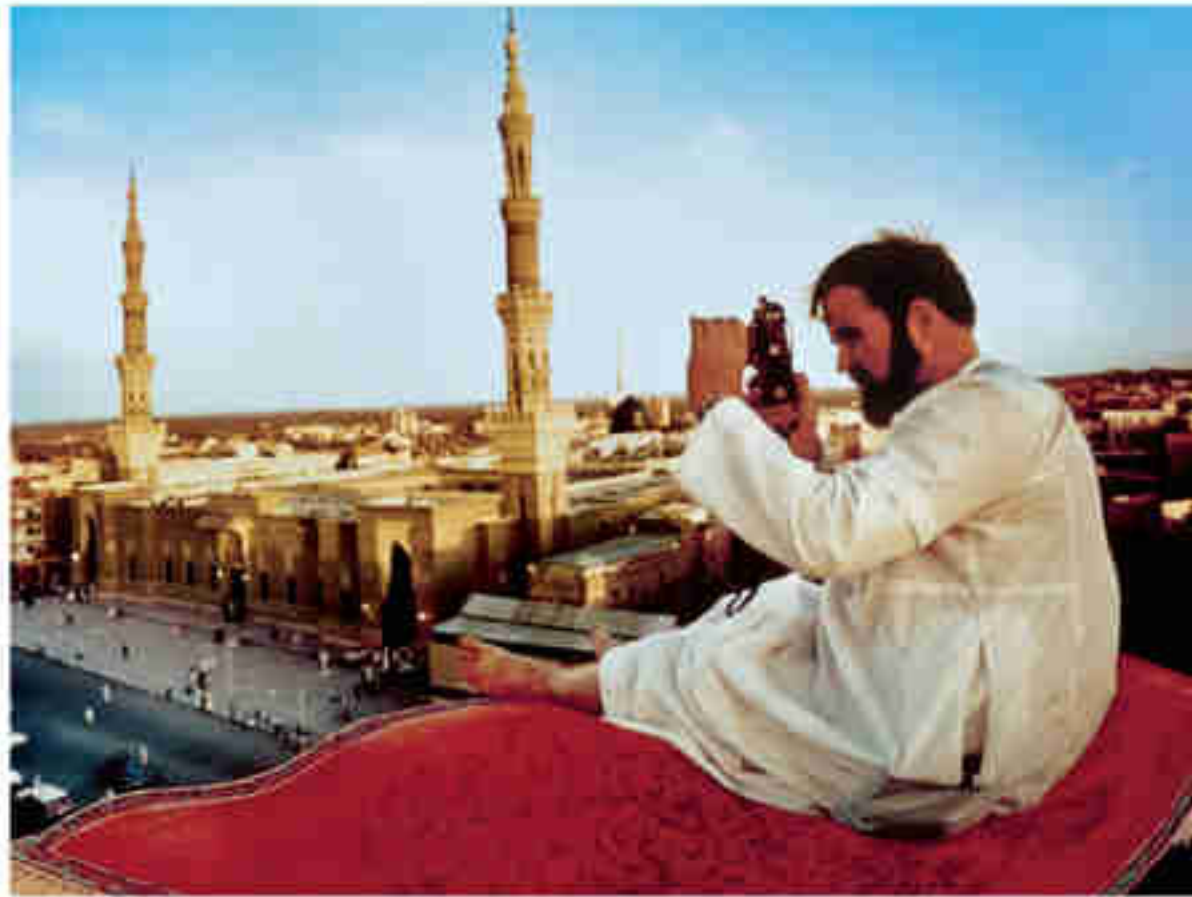
His expense accounts, too, elicited gasps from

his colleagues, especially those in Accounting. Yet the man who listed two AK-47s as "auto insurance" on his expense report from Yemen, presented the occasional gift of a sheep or goat to a Bedouin host, or bought a Cessna 185 to fly himself around Alaska was merely being practical. An early audit of his accounts by headquarters revealed a miserly average daily expenditure on meals and hotels of \$17.52. Tom, of Scottish blood, thought that a bit high. This was, after all, a man who wrote his stories on the backs of earlier manuscripts, and wore his pencils down to the nub. His home woodworking shop is a monument to thrift, littered with hoarded wood scraps and illuminated by handmade shop lights with shades of recycled aluminum pie plates.

Favored by genetics—he hailed from a line of civil engineers—Abercrombie also made his mark as a field mechanic. Once, at the *Milwaukee Journal*, he designed and built a waterproof housing for his camera out of Plexiglas and used it to photograph a Lake Michigan shipwreck for the newspaper. His boss in Milwaukee, Bob Gilka (who later became GEOGRAPHIC's director of photography), recalls that Tom and his wife, Lynn, drove their car as close to the water's edge as possible. "Then Tom tied one end of a long rope to the bumper, the other end around his waist, and waded out



*Tom was intensely private about his conversion to Islam and making the hajj to Mecca. But there's no doubt that his faith was genuine, and that it inspired him to build bridges of understanding between the Islamic world and the West.*



*Self-portrait in Mecca, 1965*



*Tom in Afghanistan, 1967*

into the lake with his homemade underwater camera to test it. He and Lynn had worked out a plan: If there was trouble, he would signal by pulling on the rope—Lynn's cue to start the car and pull Tom out of the lake."

He liked being married. In the Empty Quarter of Arabia, Tom and Lynn were traveling together when a local sheikh decided to claim Lynn, a tall, striking brunette he assumed to be Tom's daughter, as wife number four. He offered 30 camels for her. Tom countered with 50, and the pair, who were married in 1952, stayed together. "I really needed Lynn," Tom later explained. "And what would I do with 50 camels?"

Such trips together were rare in the early years. Though a GEOGRAPHIC photographer herself, Lynn was busy raising their daughter, Mari, and son, Bruce, at the couple's waterfront home in Maryland. So Tom often traveled alone, thousands of miles from home for months at a time. Yet whatever spare time he had went to writing long, tender letters to his "Rabbits" back home, or filling his suitcases with exotic knickknacks from the local suq to spring on them when he came through the front door.

By the mid-1960s, Tom was spending so much time in the Middle East that it was clear he'd found his niche. He mastered Arabic

(along with German, French, and Spanish), read the Koran, and adopted an Arabic name, Omar, on his travels. But he was not, to anyone's knowledge, religious, and few anticipated the news that arrived in a letter to Editor in Chief Melville Grosvenor, dated April 17, 1965. It was Tom, writing from Mecca: "Greetings and best wishes from Islam's holiest city. I've just had the singular honor to witness, to cover photographically, and to participate in one of the most moving experiences known to man, the annual pilgrimage to Mecca and Arafat. It has been an unforgettable personal experience and, without a doubt, the climax of our coverage of Saudi Arabia."

Tom was intensely private about his conversion to Islam and making the hajj to Mecca. But there's no doubt that his faith was genuine, and that it connected him personally to the world's Muslims. It also inspired him, through his work, to build bridges of understanding between the Islamic world and the West. Tom once said that his proudest professional accomplishment was writing and photographing "The Sword and the Sermon," his epic journey through the history and culture of the Muslim world that appeared in the July 1972 issue. The article took him to Kazakhstan, where he visited a mosque in Alma Ata and attended Friday prayers. In a letter





*Tom's photograph of the Grand Mosque, Mecca, 1965*







*His expense accounts elicited gasps. Yet the man who listed two AK-47s as “auto insurance” on his expense report from Yemen, presented the occasional gift of a sheep or goat to a Bedouin host, or bought a Cessna 185 to fly himself around Alaska was merely being practical.*



Tom, Bruce, and Lynn—Long Island, 1972



Tom in Extremadura, Spain, 1989

home he described it, with typical understatement, as one of the most emotional experiences of his life.

“I introduced myself to the sheikh, and as we talked in Arabic the growing congregation of old Kazakhs, magnificent in their costumes and manners, began to gather around. When I showed them pictures of Mecca and the pilgrimage they were damn near crying. Many rubbed their hands on my clothes and then on their face for what blessing a hajji might bring. I was pretty choked up.”

Crowned with such experiences, Tom’s GEOGRAPHIC career came to a close in 1994, and his family prepared, with some anxiety, for his homecoming. “Tom was never happier than when he was getting ready for an assignment—packing, studying maps, making plans,” Lynn said, “so I didn’t know what to expect when he retired. But he never looked back. He loved being home, building his boats, having lunch with his buddies. He was still a wanderer, of course. He’d go off on a walk and be gone for two or three hours, because he’d gotten caught up talking to a neighbor, or some perfect stranger he’d met on the road. But in general, he just went native.”

Tom toiled over his memoirs, a PG-rated version of the long, hilarious, self-deprecating tales he’d been telling over the lunch table

for decades—although writing them down, a lonely business, wasn’t nearly as much fun as telling them. His sagas did find a new audience at George Washington University, where he taught “geography with its boots on,” and at the NATIONAL GEOGRAPHIC office, where the next generation of writers and photographers always greeted his arrival as cause for celebration. Tom was a generous mentor, and on my own trips to the Middle East I followed his trail into deserts and back alleys from Jalalabad to Damascus. There I often found people who knew him and were his friends, and who welcomed me, Tom’s tribesman, as if I were his son.

The last few months of his life he spent pursuing his latest passion—stargazing—with the enthusiasm of a kid watching a parade. Even in the dead of winter, Tom, in his beret, was out in the backyard practically every night, studying the heavens through a telescope Lynn bought him for Christmas. The engineer in him, typically, spotted ways to improve the machinery, and he’d soon jury-rigged a new mount for it using parts from another telescope. Just before his own machinery gave out, he was scanning the sky charts and reading every book about the cosmos he could find.

Knowing Tom Abercrombie, I’d say he was just plotting his next expedition.





*Tom's photograph from Afghanistan, 1967*





*Tom's photograph from Afghanistan, 1967*



“ Shortly after the National Geographic Society began publishing its journal more than a century ago, founder Alexander Graham Bell was asked what subject matter his new periodical would include. His reply: ‘The world and all that is in it’—a tantalizingly broad mandate. Down through the years Lynn and I tried hard to follow it. We worked on every one of the continents and left wakes across the seven seas. The GEOGRAPHIC was witness to a century—arguably the most telling in human history—and we were fortunate to have spent nearly half of it there.

A page from Tom’s memoirs reflects on the changes he and Lynn saw over the course of his 38-year GEOGRAPHIC career. Few knew the world better, or loved its people more, than Tom Abercrombie.

Ours is a story—a picture story—of two people before whom was spread out the greatest of treasures: our planet Earth. For four decades we traveled aboard that magic carpet with the yellow border.

“Much of that world has changed since our days in the field—not always for the better. Many of the smiles we captured are no more—bleached by tourism, stricken with war, and battered by revolution. Multi-faith Lebanon is torn by sectarian anger; Saudi Arabia is constrained more than ever, as a government of wealthy princes faces off against its more fanatic citizens; Cambodia struggles to rid itself of a decades-long nightmare; Afghanistan bleeds from foreign invasions and its own medieval fundamentalists; Iran remains at loggerheads with the West; and Iraq lies in ashes. So, in a sense, my work records history as much as geography. As has often been said: The past is another country.” □



*Tom in U.S.S.R., 1972*

—TOM ABERCROMBIE  
*May 2005*





# *Where Curr*





# *ents Collide*

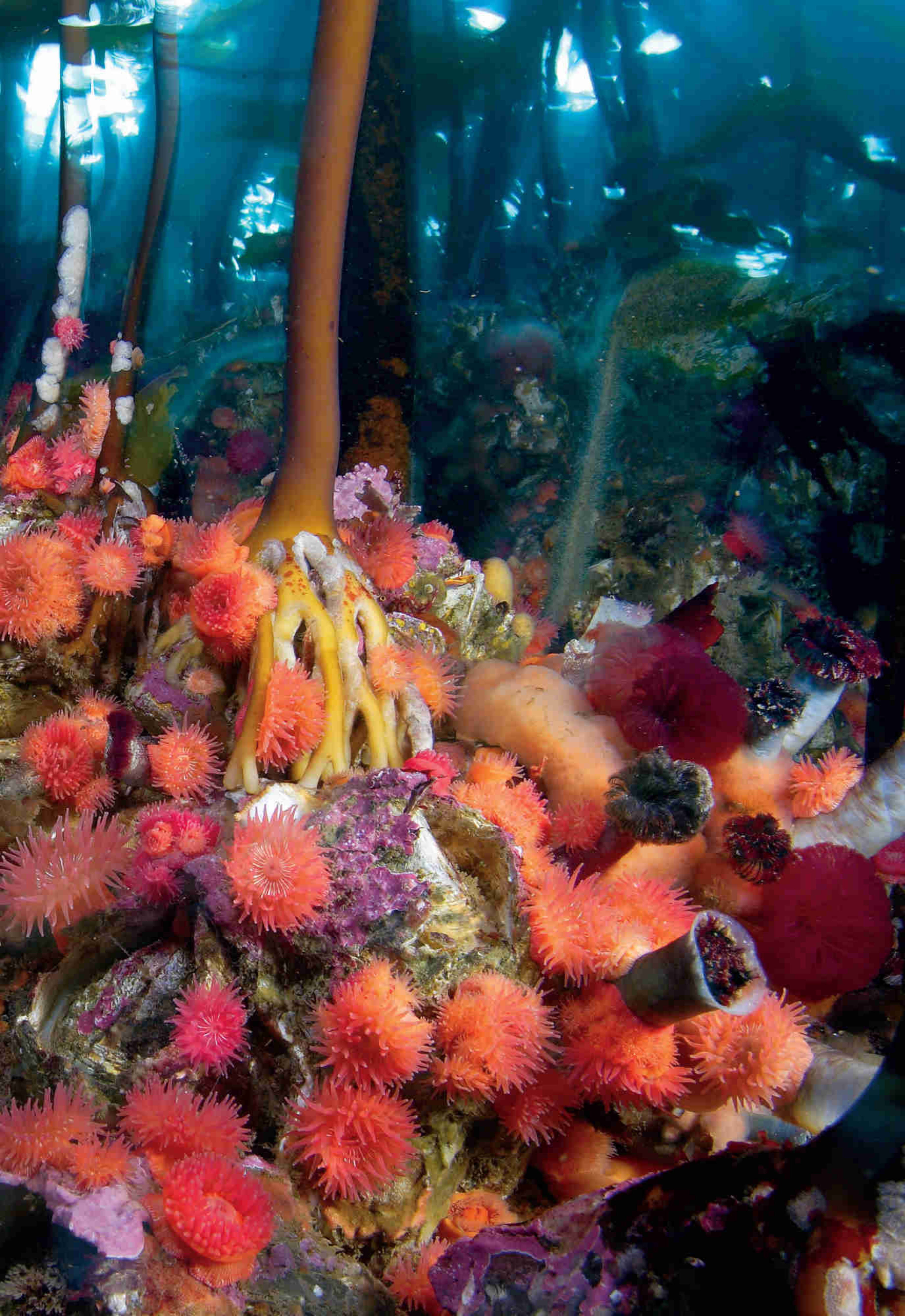
*Herring flash in Queen Charlotte Strait off Canada's Vancouver Island, realm of rocketing tides.*



*In a swaying kelp forest, anemones bloom among lavender bryozoans, challenged yet fed by the waters of Queen Charlotte Strait. Life explodes in every crevice along the straits between Vancouver Island and mainland British Columbia, nurtured by the dynamics of fast, nutrient-rich water.*











*The rush of ebb tide at Nakwakto Rapids whips around Turret Rock at 14.5 knots (16.7 miles an hour). Locals call it Tremble Island, though seismographs don't support the belief that the rock shudders from the water's force. Slack tide here lasts about 15 minutes, then the frenzy of flood tide hits.*







*Text and photographs by Paul Nicklen*

*It seems insane to dive here. But it's the only way to witness the energy packed by some of the world's fastest water.*

So, equipped for scuba, my diving partner and I leave the shelter of a bay called God's Pocket at the north end of Vancouver Island and turn our small boat toward Nakwakto Rapids. What greets us makes our knees go weak. As glacier-carved fjords drain with the ebb tide into Queen Charlotte Strait, the fury of released water gushes past Tremble Island at 14.5 knots. Whirlpools spit wide swaths of foam, and seven-foot standing waves explode into the sky.

At slack tide, the water quiets enough for us to take the plunge. Descending 40 feet, we struggle against still powerful surges from all sides. Yet the base of Tremble is a palette of delicate beauty: rocks swollen with pearly gooseneck barnacles, nudibranchs, sponges, and hungry bouquets of feather duster worms. These dense colonies of animals thrive in the straits of Vancouver Island because the water is a vast protein shake, blended by upwellings, back eddies, and surges directed by the ebb and flood of tides. Phytoplankton and zooplankton rip through the water, practically force-feeding creatures adapted to cling to rocky ledges or the muddy ocean floor. These nutrients foster life stacked upon life stacked upon life.

The productive mayhem charges a food chain that reaches up through herring, salmon, orcas, and humpback whales. Fishermen (below, in the Strait of Georgia) harvest the rich herring population primarily for the roe. This major British Columbia fishery crashed in the 1960s as a result of overfishing. Government quotas, set at 60 million pounds last year, have helped herring numbers rebound. The most troubling threat now facing this region: Canada's ban against offshore oil exploration is under review. If the federal ban is lifted, British Columbia's provincial ban would likely also fall. Previous exploration has identified four off-

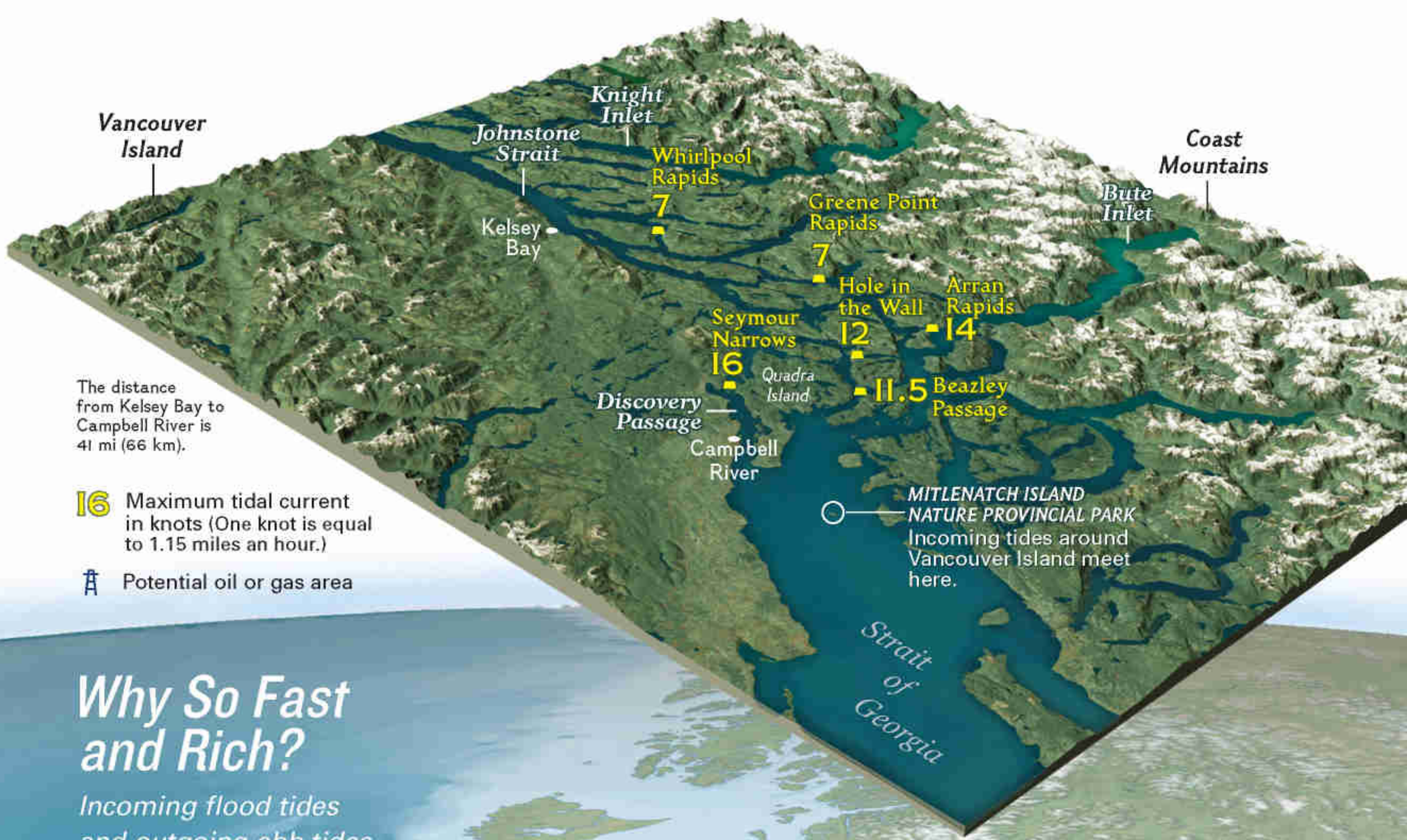


shore beds with potential for oil and natural gas (map, right). On top of the environmental disruption caused by drilling and increased ship traffic, the prospect of an oil spill spreading through these swift and vibrantly productive waters is a nightmare I hope will never come to pass.

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**Fast Zone** Download wallpaper and watch video of kayakers daring Skookumchuck Rapids at [ngm.com/0608](http://ngm.com/0608).





The distance from Kelsey Bay to Campbell River is 41 mi (66 km).

**16** Maximum tidal current in knots (One knot is equal to 1.15 miles an hour.)

**A** Potential oil or gas area

## Why So Fast and Rich?

Incoming flood tides and outgoing ebb tides accelerate through the narrow straits and pick up more speed as they funnel through channels created by islands (inset).

The tides carry and mix nutrients from immense deepwater upwellings at both the northern and southern entrances. What makes these straits an exceptional cauldron of life is the way in which ocean tides interact with fresh water from the Fraser River and from snowmelt flowing out of fjords. As the lighter outbound fresh water rides over ocean water, it pulls some of the salt water into it. This creates a vacuum of sorts that draws even more deep ocean water—and more nutrients—into the straits.

Scale varies in these perspectives. The distance from Port Hardy to Victoria is 244 miles (393 kilometers).

IMAGES: GLOBAL LAND COVER FACILITY, NASA CONSULTANTS, DEPARTMENT OF FISHERIES AND OCEANS, CANADA; WOODS HOLE OCEANOGRAPHIC INSTITUTE  
SHELL T. KIMBLE AND DAVID E. CHANDLER, NGM MAPS





## **Gem Tones**

*The Emerald Sea, as these chill waters are called, turns deepest green in summer when plankton and algae flourish. Predators grow large in the churning pea soup—like this seven-foot wolf eel fish with a volleyball-size head (below). A giant Pacific octopus (life-size eye, middle right) might reach 20 feet. I expected to find octopuses hiding in caves when tides were flying, but that’s when they feast, flattening their bodies to undulate with the current as they snake along life-laden walls. A sculpin known as a red Irish lord (life-size, bottom) wears its eyes high and moves each independently, giving the ambush predator a detailed view. To see how nutrient-saturated currents feed creatures like sea urchins, I poured a nontoxic dye and watched it flow not around the urchin colony but right through it (top).*

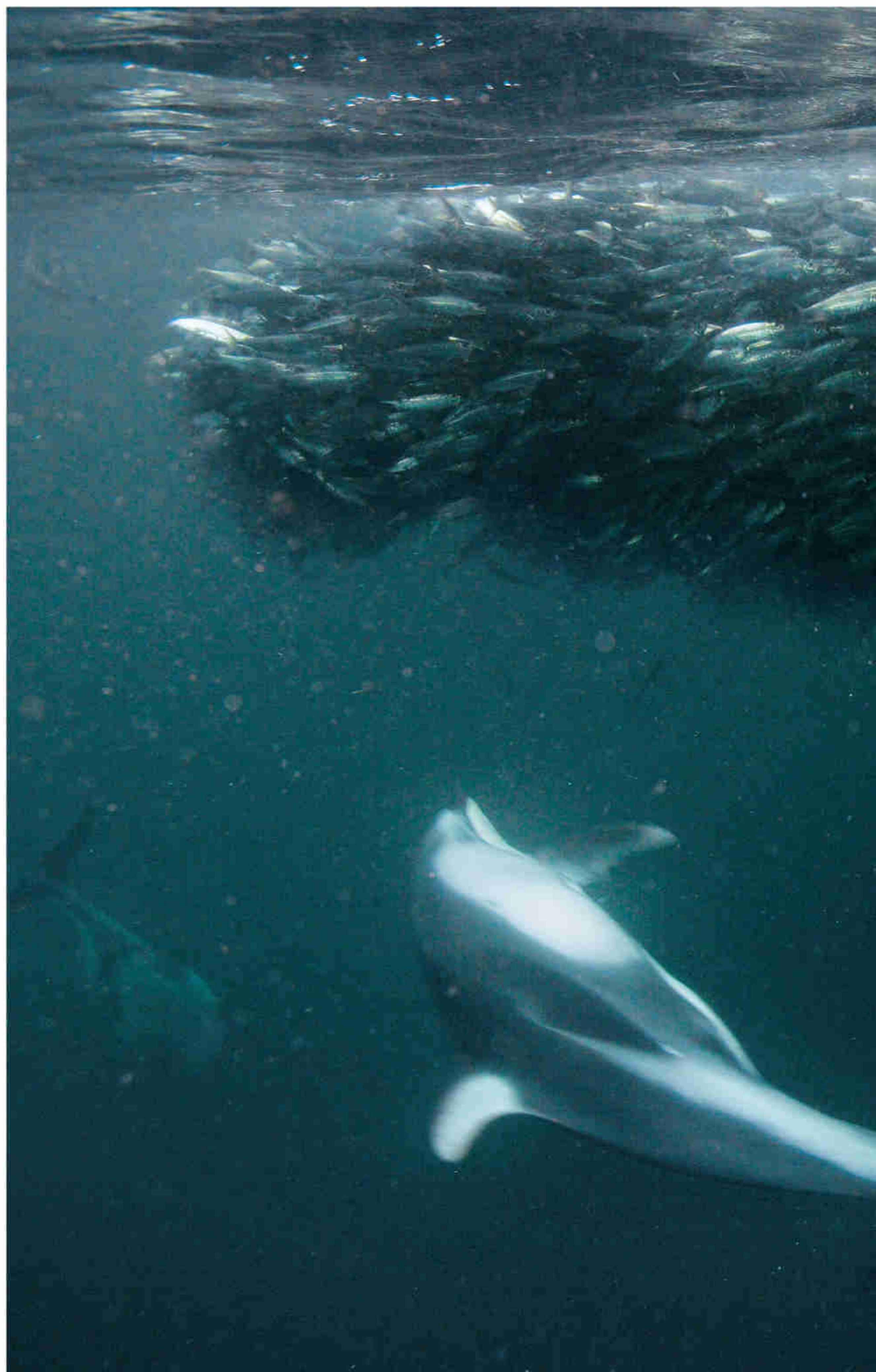








# *Whirlwind Banquet*





*Pacific white-sided dolphins circle a school of herring like a cyclone, pressing them into a ball near the surface and plucking from the edges. If the ball expands, the dolphins dart in or release rushes of bubbles to push the fish back into formation. Gulls and auklets dip into the fray, helping keep the ball intact. At one point the entire school engulfed me. I pulled back, mindful that vastly bigger herring fans—humpback whales—were nearby.*







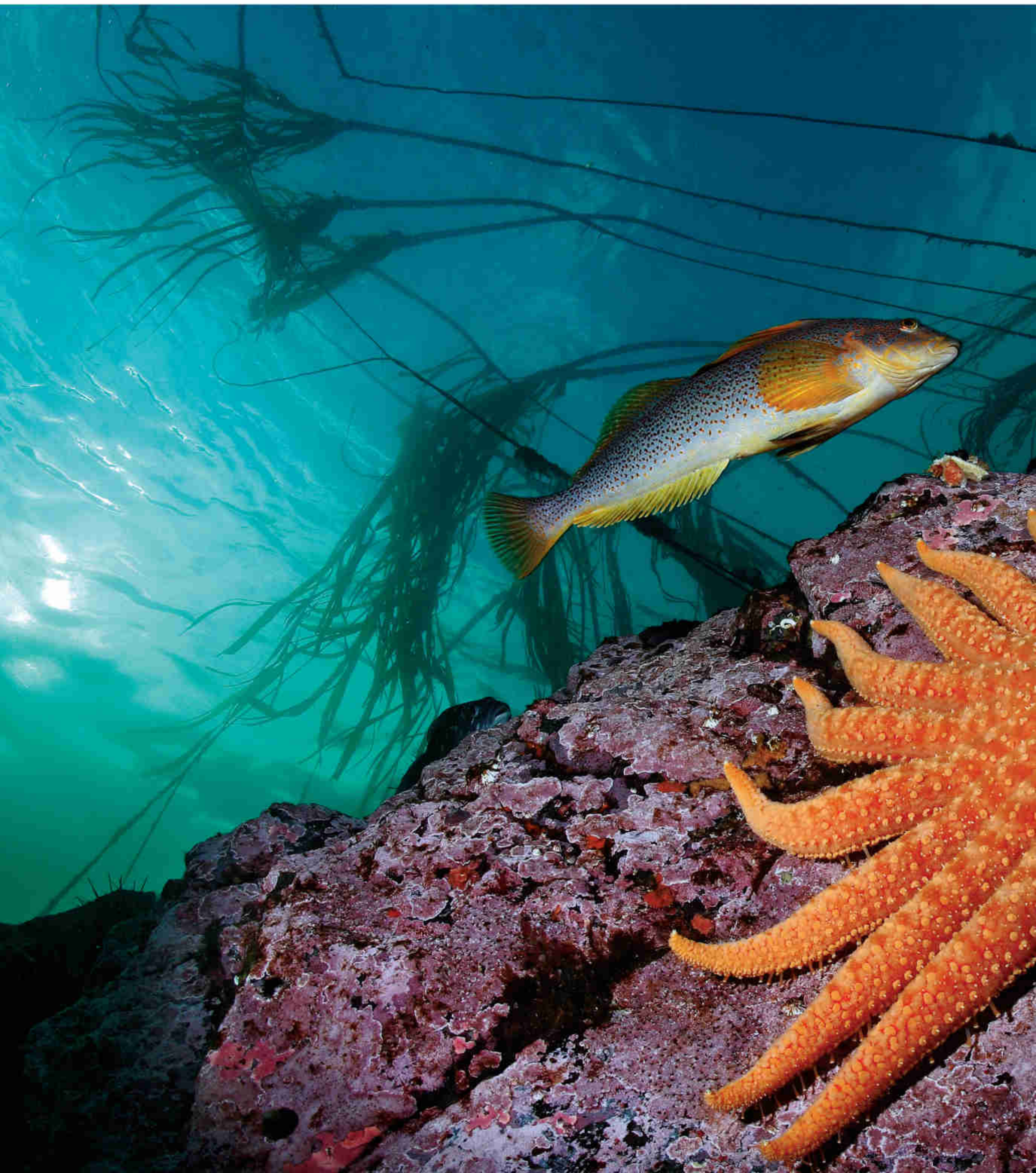


***Clinging for Life*** *No strangers to ebb and flow, gooseneck barnacles (below) clamp to rocks with a cement so strong that scientists want to re-create it for commercial use. The bright-lipped filter feeders prefer strong currents and ocean surges, like the rapids around Tremble Island, where they cluster in 40-foot-long beds. A similar natural adhesive lets plumose anemones dangle at a site called Browning Wall (bottom). The anemones survive out of water for hours during low tide by retaining water in their body cavities. Submerged, they open to resemble fluffy heads of cauliflower and feed on zooplankton, fish, and jellyfish. The feathers of a two-foot-tall sea pen (opposite) house polyps that snare zooplankton. If threatened, the animal expels the water inflating its body and hides in the seafloor mud. Such are the sights that make Vancouver Island's straits a premier cold-water destination for experienced divers.*





# *Rock Steady*





*Nineteen arms of suction power anchor a two-foot-wide sunflower star beneath Quadra Island. Overhead a greenling swims against current that tangles whips of bull kelp. One of the world's largest and fastest stars, with speed approaching a lively five feet a minute, the voracious sunflower easily overpowers urchins, clams, and other invertebrates. In this turbulent domain, life goes bold and vigorous—despite the wild waters, and because of them. □*







# ANTS

## The Civilized Insect



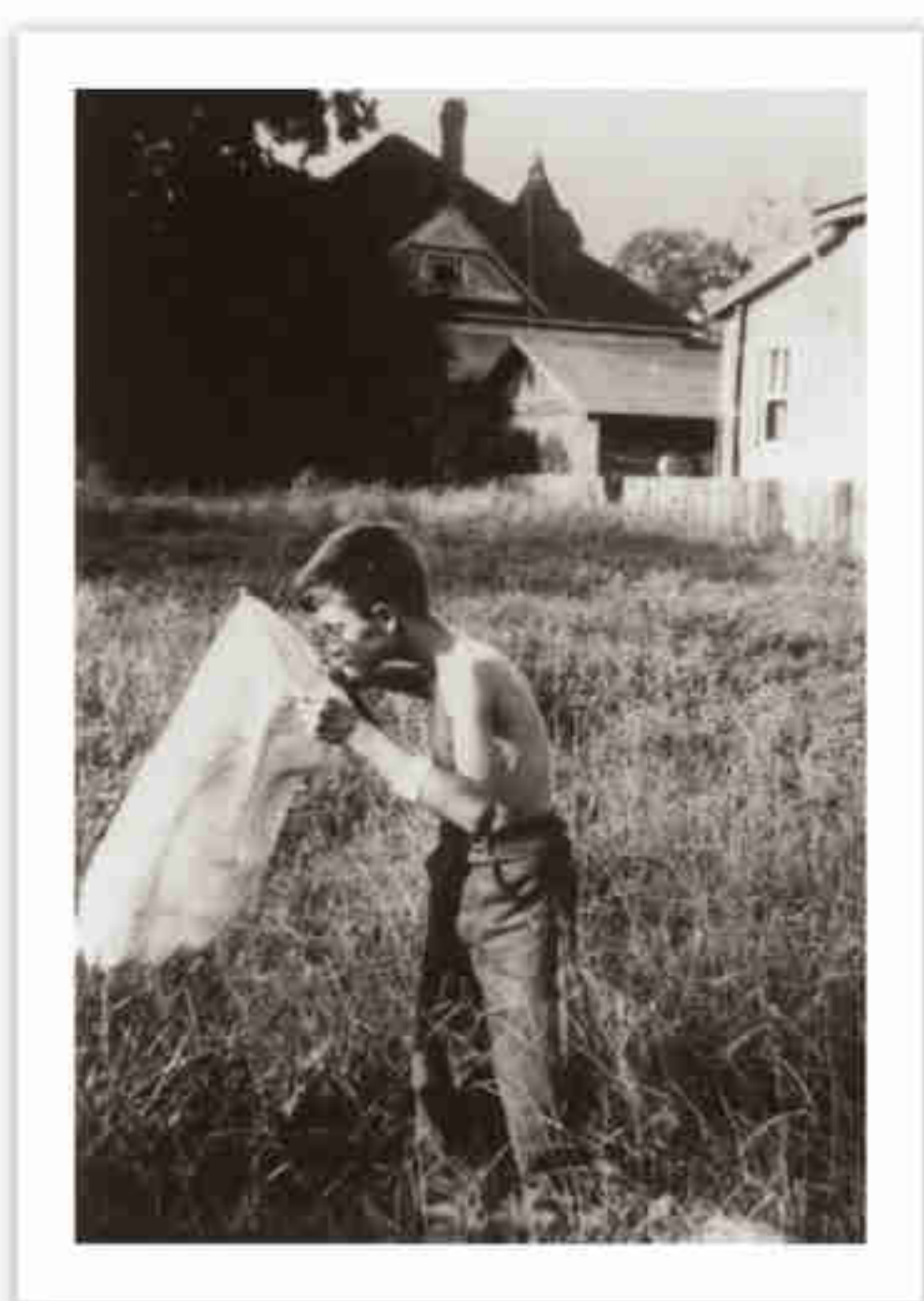
By Edward O. Wilson

In Japanese the word “ant” is intricately written by linking two characters: one meaning “insect,” the other meaning “loyalty.” Altruistic and cooperative toward one another, nestmates readily go to war to preserve their colony. Renowned biologist and lifelong ant observer Edward O. Wilson introduces our new occasional series on these highly social creatures.



ANTS ARE OUR CO-RULERS OF THE LAND. An estimated ten thousand trillion strong worldwide, they weigh very roughly the same as all of humanity. They abound everywhere except on icy mountain peaks and around the Poles. From underground to tree-tops, they serve as the chief predators of insects and other invertebrates and the principal scavengers of small dead bodies. Although their 12,000 known species compose only about 1.4 percent of the world's insect species, their share of the collective body weight is easily ten times greater.

I was first drawn to these remarkable creatures almost 70 years ago as a boy in Washington, D.C. Inspired by the tales of Frank Buck and other wildlife adventurers, I launched my own expeditions from our family apartment into the “jungles” of Rock Creek Park. Ants especially intrigued me because of an article by William M. Mann in the August 1934 NATIONAL GEOGRAPHIC: “Stalking Ants, Savage and Civilized.” Mann



Wilson at 13, looking for bugs in Mobile, Alabama, during the summer of 1942.

ELLIS MACLEOD

was also director of the National Zoo, hence doubly my hero. The myrmecological lineage continued decades later with Mark Moffett, who earned a Ph.D. under my direction at Harvard and whose groundbreaking photography of ants focuses in this issue on army ants.

Ants are important for more than their ubiquity and environmental impact. They also exhibit social behavior as exotic as any we may ever hope to find on another planet. For most of each year colonies consist only of females: queens that reproduce for the colony and infertile workers that conduct all the labor. Males are bred and kept for short periods, exclusively for the insemination of virgin queens. The communication

systems of ants are radically nonhuman. Where we use sound and sight, they depend primarily on pheromones, chemicals secreted by individuals and smelled or tasted by nestmates. Since the brain of an ant weighs less than one-millionth as much as a human brain, it is not surprising that a given species produces just ten to twenty signals. Unlike human language, these messages are entirely instinctual.

These marvelous little creatures have been on Earth for more than 140 million years. The most complex social organizations among them, such as those of the army ants and leafcutter ants, rank with Earth's greatest wildlife spectacles. Ants easily outlasted the dinosaurs, and they will easily outlast humanity should we stumble. □





# ARMY ANTS

## Inside the Ranks





Larger but outnumbered, an army ant soldier of the species *Eciton burchellii* is corralled by workers of a rival army ant species, *Eciton hamatum*. Their two colonies sparred for an hour in a chance meeting, then retreated without fatalities. These army ants never kill each other, but they handily devour creatures many times their size.







## Text and photographs by Mark W. Moffett



Linking toe to toe, *Eciton burchellii* army ants (left) use their own bodies to form massive nests called bivouacs. The nomadic raiders keep no permanent nests but suspend their bivouac beneath a log or woody overhang (right). *E. burchellii* is one of 150 army ant species in the New World; more than 170 other army ant species thrive in the tropics of Asia, Africa, and Australia.

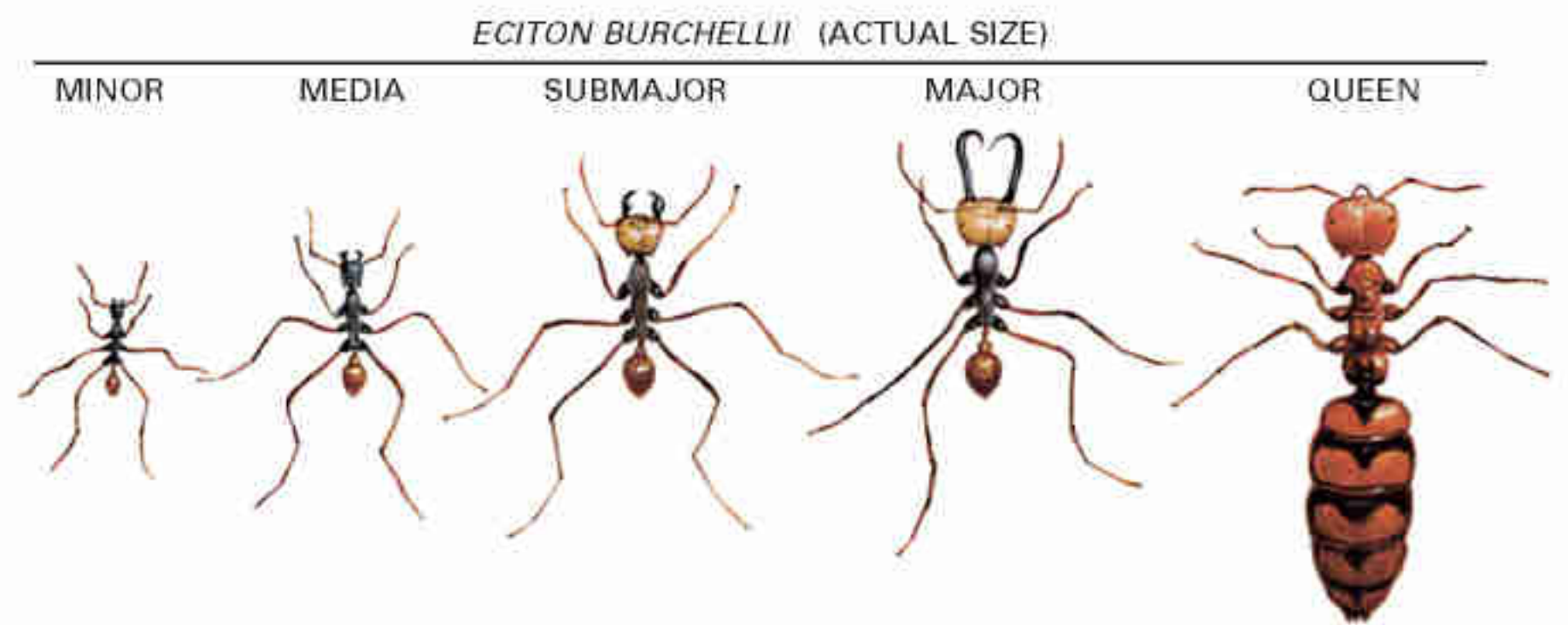
FORGET LIONS, TIGERS, AND BEARS. Forget even our own famously aggressive species. When it comes to the art of war, it's army ants that will make you break into a cold sweat. Armored tough, with machete jaws, these masterful fighters hack and dice prey vastly larger than themselves by acting in numbers beyond easy comprehension. Imagine hordes of spear-wielding humans at a woolly mammoth's feet. That's the scale of army ant operations when they're attacking a tarantula or scorpion. Army ant colonies succeed at making tens of thousands such kills each day. Folklore to the contrary, their prowess does have limits. Their dragnets don't take down livestock or people (though some African species occasionally live up to that image).

I went to one of the best places to observe army ants in action, Barro Colorado, a six-square-mile island in a lake created by the Panama Canal and home to perhaps 50 colonies of *Eciton burchellii*, the most studied army ant in the world.

The ways of *E. burchellii* helped give rise to the name army ant. Their colonies are huge, ranging from 300,000 to 700,000. They are mobile, moving from nest site to nest site. Though not all army ant species share these characteristics, there's one hallmark they have in common: a shock-and-awe hunting strategy. Other ants search for food individually, sometimes using scouts. Army ants set out en masse. Being blind, they can't see what's ahead of them, but moving in such numbers they easily overwhelm their prey. For *E. burchellii* that's usually non-army ants and large arthropods. They can also kill, but don't eat, lizards, snakes, and frogs that fail to get out of the way. Their attack formation is called a swarm raid. As many as 200,000 ants leave the nest in a swarm that broadens into a fan as wide as 15 yards. Specialized birds follow the raiders, picking off prey as it scatters in vain attempt to survive.





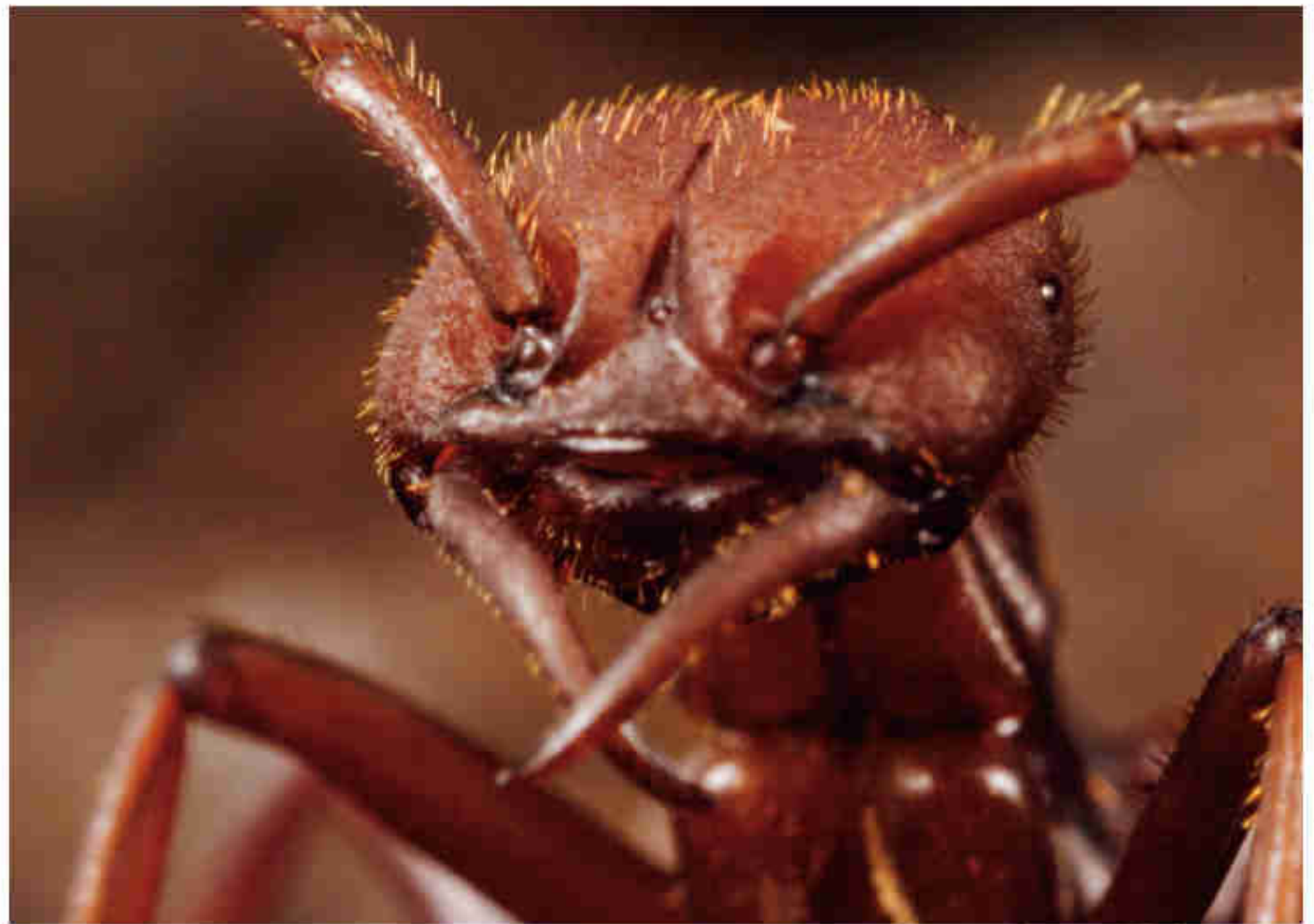


## In Her Majesty's Service

Carrying the pupae of the next generation (below), a colony on the move marches the length of a football field every day. *E. burchellii* alternate between nomadic and stationary phases, linked to the colony's reproductive cycle. Four sizes of workers (above) live to nourish and protect the queen (close-up, facing page). The three smallest workers kill and carry the colony's prey and also feed the queen and the larvae. Majors, or soldiers, defend the colony. Workers live only a few months, but the queen survives for several years. Her demise before the birth of a new queen would send the colony into chaos—and doom it.

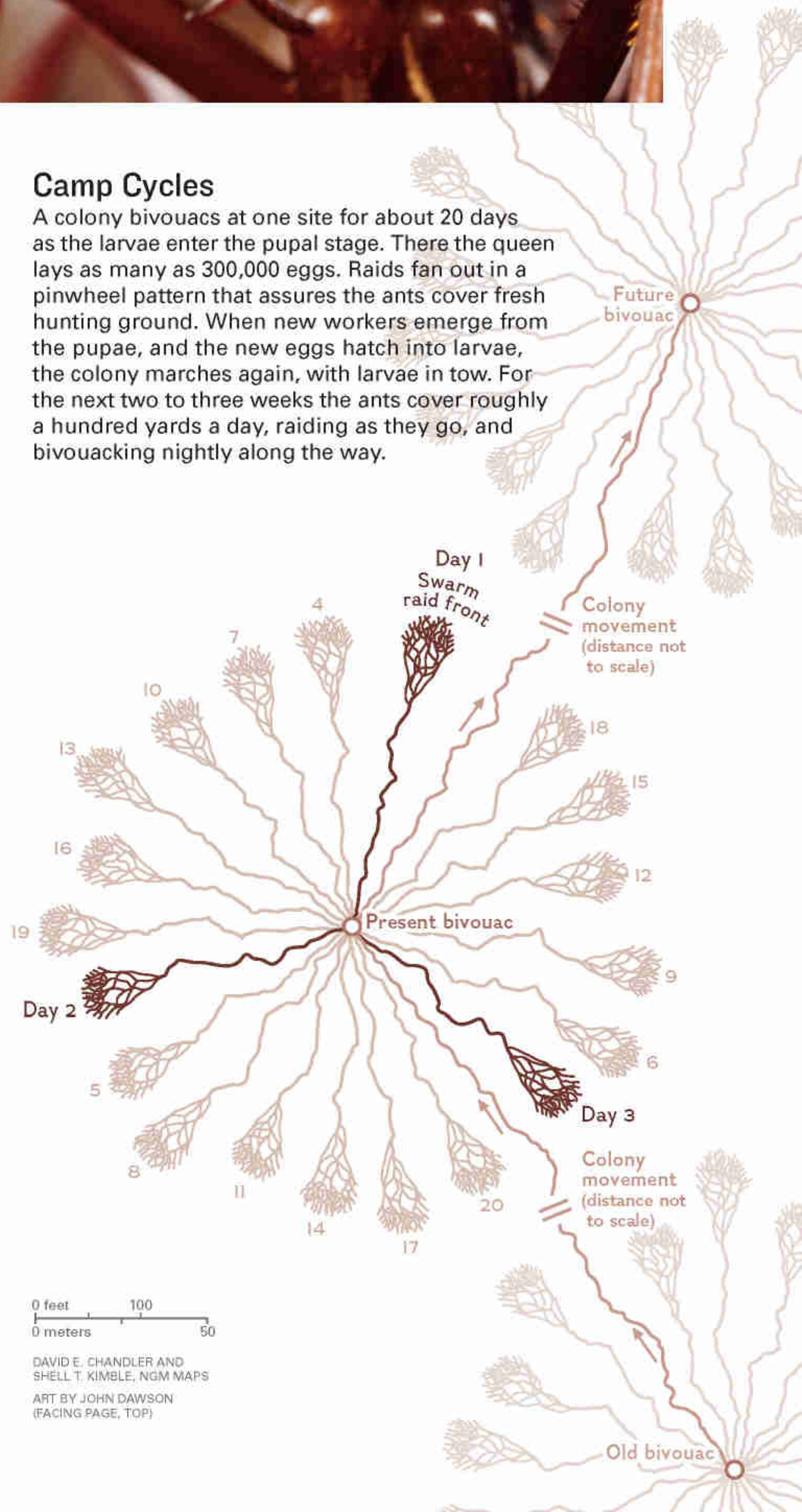






### Camp Cycles

A colony bivouacs at one site for about 20 days as the larvae enter the pupal stage. There the queen lays as many as 300,000 eggs. Raids fan out in a pinwheel pattern that assures the ants cover fresh hunting ground. When new workers emerge from the pupae, and the new eggs hatch into larvae, the colony marches again, with larvae in tow. For the next two to three weeks the ants cover roughly a hundred yards a day, raiding as they go, and bivouacking nightly along the way.



0 feet 100  
0 meters 50

DAVID E. CHANDLER AND SHELL T. KIMBLE, NGM MAPS  
ART BY JOHN DAWSON (FACING PAGE, TOP)





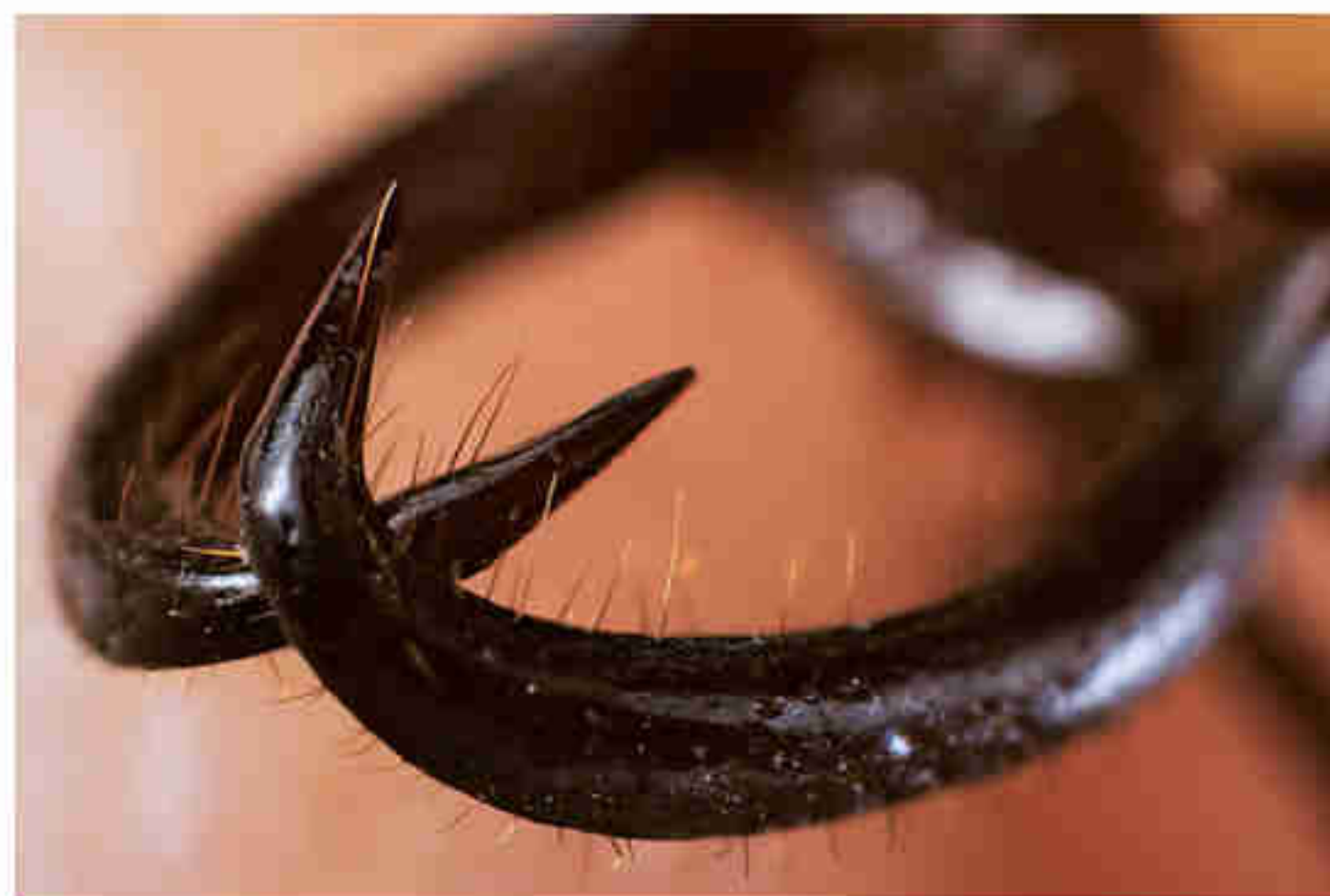
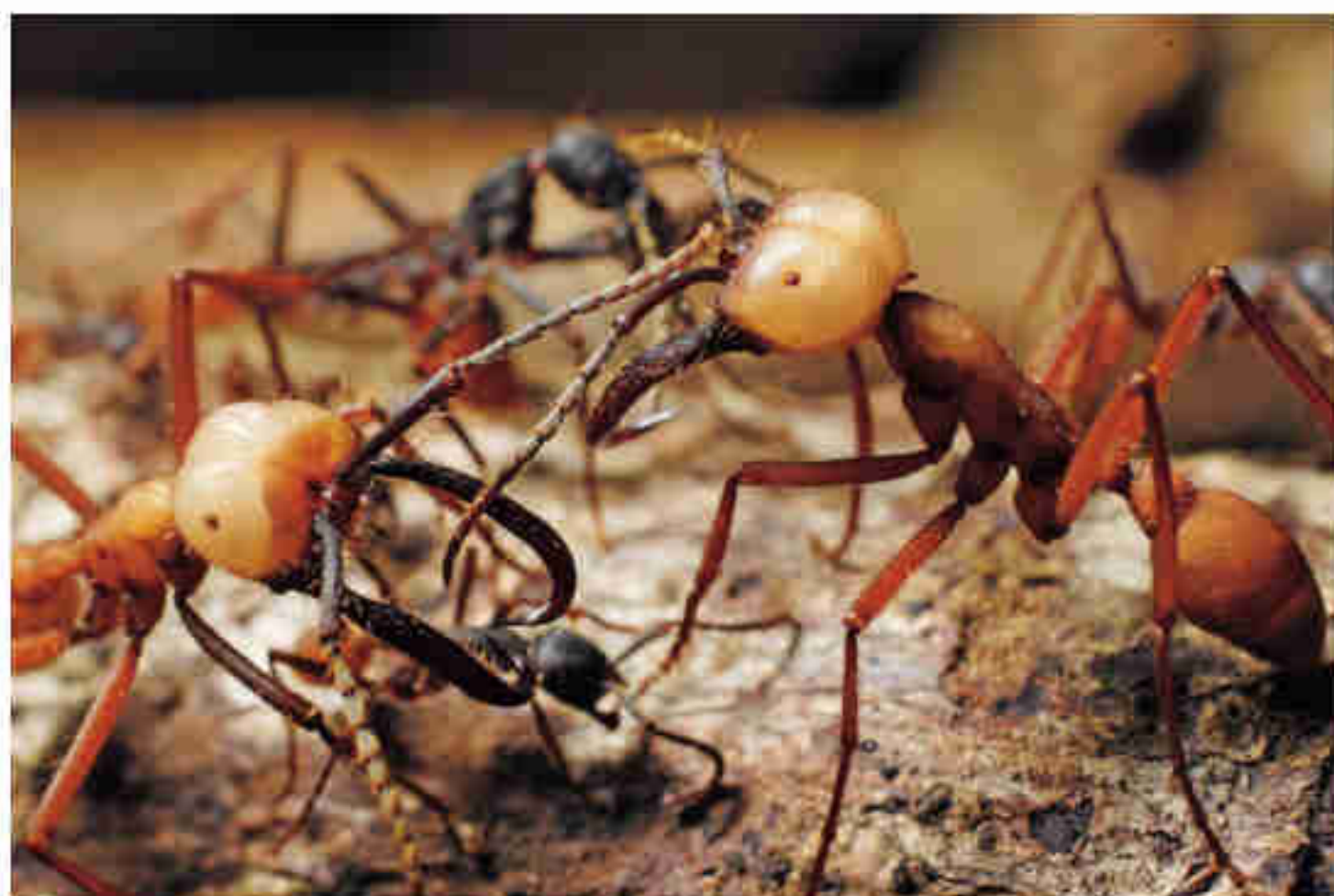
## Teamwork Delivers the Catch

A fragment of what might have been a centipede, ripped apart during a swarm raid, comes back to the bivouac in the jaws of a submajor; a media worker lifts from behind to keep the end from dragging. The smallest workers, the minors, act as living roadfill, at bottom. Along with some media workers, they hunker down in potholes to smooth the path.



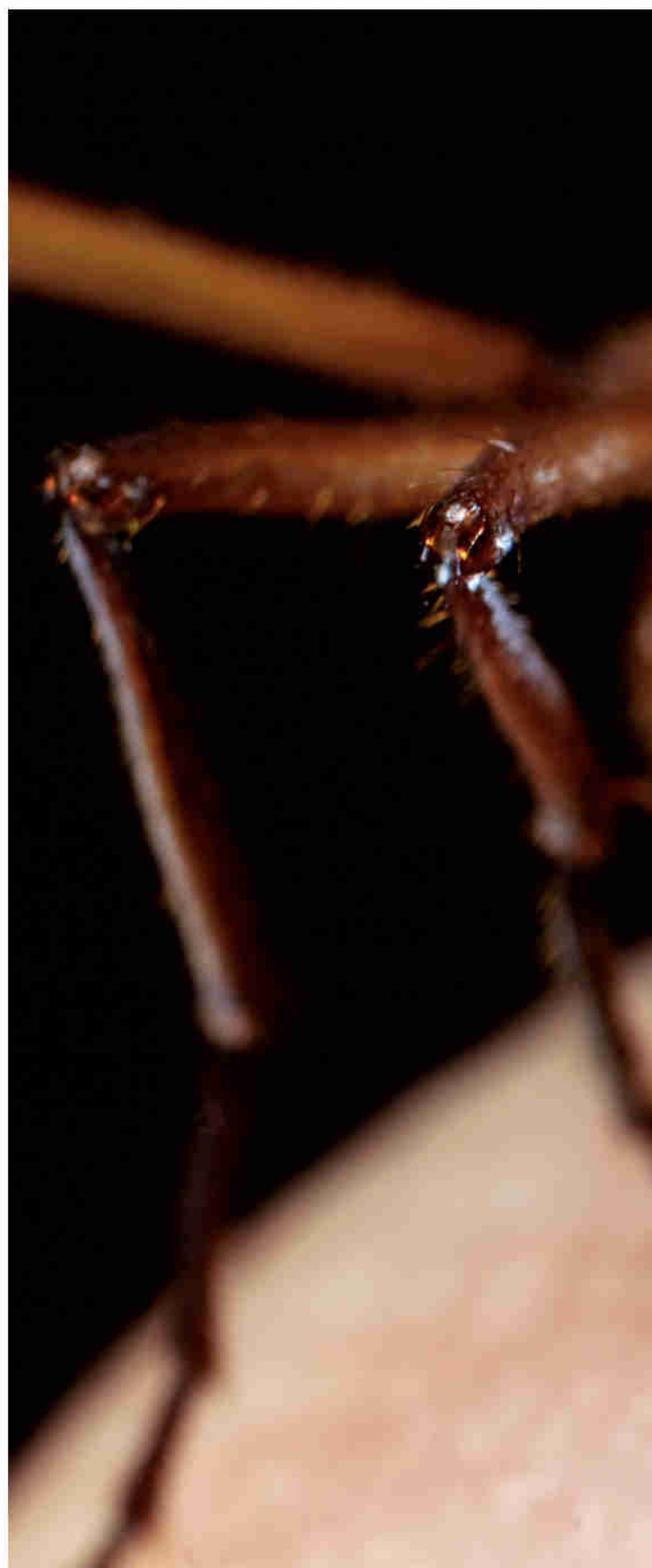






## Warrior Caste

Terrorizing any potential enemy is the full-time job of *E. burchellii* soldiers. They don't hunt, they don't clean, they don't tend the young. They can seem clumsy as they patrol the edge of the trail (top left), flaring their oversize jaws. If intimidation tactics don't send foes running, soldiers bite—and the attack is often suicidal. Because the tips of their jaws are bent like a fishhook, with a knife blade along the inner margins (top right), the soldiers can't extract them. Amazonian tribes have used soldier ants to suture wounds, snapping off the bodies and leaving the heads in place. The *E. hamatum* soldier penetrating my thumb (right) also pivots her abdomen to sting, delivering a poison that turns my skin red.











## All for One, One for All

Back from the front lines of a swarm raid, a submajor (above) is cleaned of blood-like hemolymph shed by insect prey. Workers on a raid mark the trail with pheromones for others to follow and to find their way back to the colony. Ants returning laden with food use the middle of the trail, forcing unencumbered outbound ants to the sides. Other ant species that use the same trails for days or weeks take time to maintain them, clearing debris and moving soil. Nomadic *E. burchellii* don't have that luxury; each day brings new terrain. Faced with an engineering challenge, like a gap between leaves (left), minors and medias link their bodies to form a living bridge, and the army marches on. □

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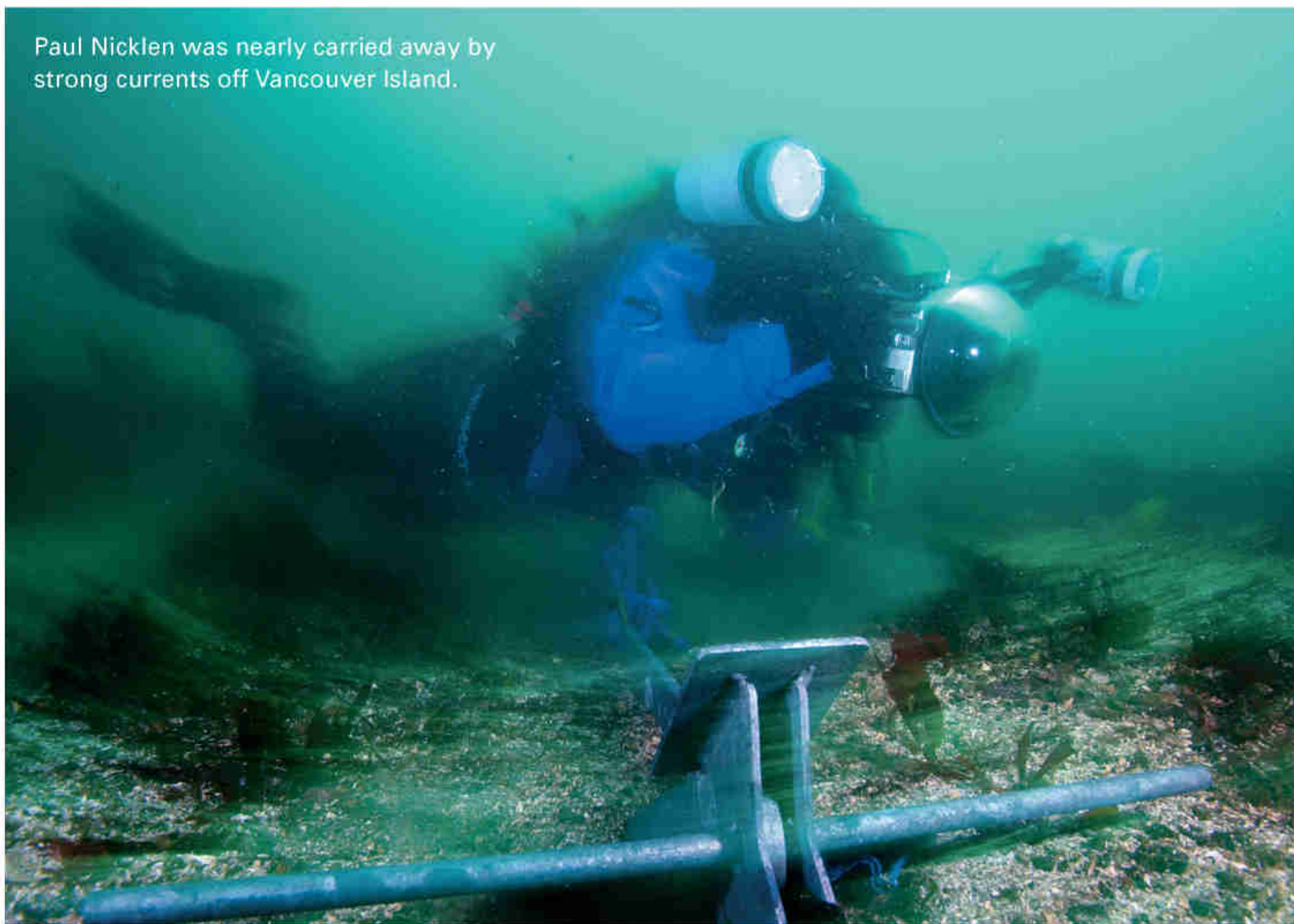
**Swarm** Watch video of army ants in action, and send e-greetings at [ngm.com/0608](http://ngm.com/0608).







Paul Nicklen was nearly carried away by strong currents off Vancouver Island.



**ON ASSIGNMENT Anchored Away** “The current was so strong I couldn’t control my legs. They were whipping around like pieces of plastic in the wind,” says Paul Nicklen, photographer for “Where Currents Collide.” The waters off Vancouver Island roared with dangerously fast currents, some of which, he remembers, “could take you straight to the bottom.” Nicklen first tried to stabilize himself by sticking one arm in the mud while taking photos with the other. Other times, he clung tenaciously to underwater ledges like a dry-land rock climber. But he knew he needed another way. “I got an idea from how the animals in the story anchor themselves,” he says. Nicklen finally took a boat anchor and a rope, and secured himself to the bottom.



The mandibles on an army ant’s head grasp Mark Moffett’s thumb.

**ON ASSIGNMENT Ant Man** “Ants provide an alien continent to explore,” says Mark Moffett. “There is high drama at our feet.” He should know: “For three years I was in charge of Harvard’s ant collection, which is the biggest in the world.” Moffett, who wrote and photographed this issue’s story and is working on a book about the insects for the Harvard University Press, observes the creatures with a very special tool—his camera. “For me, a camera is a portable microscope. If the ants happen to do something cool, I press the button,” he explains. He also lets them run right over him. “You have to ignore discomfort while taking pictures. Ants can attack in huge numbers, but I don’t notice it.” He recently received an honor worthy of notice. Eminent biologist—and Moffett’s doctoral adviser at Harvard—Edward O. Wilson named a new species of ant for him: *Pheidole moffetti*.



Since 1948, Direct Relief International has assisted people in need—both in poor regions of the world and wherever disaster has struck—by providing essential resources to locally-run health programs.

In 2003, Direct Relief International provided more than \$90 million in material assistance in 61 countries—enough provisions to offer care to an estimated 10 million people. To learn more, visit [www.directrelief.org](http://www.directrelief.org).



## Partners in disaster relief

Natural and man-made disasters take an alarming toll on their victims. Those who survive often are left tragically devastated. Helping them requires compassion and teamwork to ensure that the necessary medical and humanitarian supplies are distributed quickly to all those who desperately need them.

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Helping all people  
live healthy lives

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<sup>1</sup> Please visit [www.bd.com](http://www.bd.com).

<sup>1</sup> "America's Most Admired Companies" annual survey, 2005; *FORTUNE* magazine, March 7, 2005.  
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David Burnett photographs a ruined neighborhood near the London Avenue Canal in New Orleans.

## ON ASSIGNMENT

**One Shot** To make his haunting photographs of New Orleans, David Burnett used a 1950s-era Speed Graphic. Once focused, the large-format camera can usually only record one or two images before a subject moves—and refocusing is necessary.

“Having just one shot at it forces you to figure out what you want to say and how you want to say it,” he explains. Yet no picture could capture the extent of the damage done to the region—or its people. Says Burnett, “You just can’t imagine what water can do when it’s angry.”

## August Contributors

**David Burnett** captured a drowned Gulf Coast for his photographic portfolio, “Home No More” (page 42). The prizewinning photojournalist is a cofounder of Contact Press Images photo agency.

**Ernest J. Gaines**, a native of Louisiana, wrote the essay, “Where Have You Gone, New Orleans?” (page 54). The novelist is a professor of English and writer-in-residence at Louisiana State University.

**Thomas Hayden** delved into the science of hurricanes to write “Super Storms” (page 66). He is a former staffer at *U.S. News & World Report* and *Newsweek*.

**David Roberts** wrote about Utah’s ancient Fremont culture in “Guardian of a Ghost World” (page 78). His most recent book is *On the Ridge Between Life and Death*.

**Ira Block**, a longtime contributor to the *GEOGRAPHIC*, photographed “Guardian of a Ghost World.”

**Adam Goodheart**, author of “Seasons of Smoke” (page 90), is a fellow at Washington College’s C. V. Starr Center for the Study of the American Experience.

**Michael Melford** is known for his lyrical images of landscapes. He was the photographer for the story on the Great Smoky Mountains National Park.

**Don Belt** wrote “A Geographic Life,” a tribute to the late NATIONAL GEOGRAPHIC staff writer and photographer Thomas J. Abercrombie (page 108). Belt is the magazine’s Senior Editor for Geography & World Affairs.

**Paul Nicklen** braved some of the world’s fastest currents off Canada’s Vancouver Island to photograph and write “Where Currents Collide” (page 120).

**Edward O. Wilson** wrote “Ants: The Civilized Insect” (page 136). The famed biologist is a professor emeritus at Harvard and has twice won the Pulitzer Prize.

**Mark W. Moffett** wrote, photographed, and was bitten by his tiny subjects for “Army Ants” (page 138). This article is the first in Moffett’s new occasional series on ants for the magazine.

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**Tales From the Field** Learn more about NATIONAL GEOGRAPHIC contributors in Features at [ngm.com/0608](http://ngm.com/0608).



# If You Purchased the Flavor Enhancers MSG or Nucleotides from Entities other than the Manufacturers,

## Your Rights may be Affected by a Class Action Settlement.

There is a proposed Settlement of a class action lawsuit on behalf of purchasers of MSG or Nucleotides or products containing MSG or Nucleotides. The class action is named *Eugene Higgins v. Archer Daniels Midland Co.* (D-202-CV-200306168) and is pending in the Second Judicial District Court, County of Bernalillo, State of New Mexico.

### What Is the Class Action About?

The Settlement of the class action lawsuit will resolve antitrust, consumer protection, and unfair trade practice law claims brought on behalf of all persons or entities in the states listed below who indirectly purchased MSG (monosodium glutamate) or Nucleotides (disodium guanylate (DSG) and disodium inosinate (DSI)) manufactured or sold by any of the Defendants or Co-conspirators. Indirect purchases are purchases made from entities other than the manufacturers listed below.

### What Are MSG and Nucleotides?

MSG and Nucleotides are food flavor enhancers. MSG and Nucleotides are used in dehydrated soups and gravies; canned meat; sausage; prepared meals; tomato sauce and ketchup; mayonnaise; snack foods (mix in salt); soy sauce; crab, prawn, fish and shellfish (preserved); Asian cuisine; prepared vegetables; and a variety of other products.

### Who Is Involved?

Anyone present in the states below who indirectly purchased MSG or Nucleotides between January 1, 1983 through November 1, 1999 is a Class Member:

Arizona, Arkansas, the District of Columbia, Florida, Hawaii, Iowa, Kansas, Louisiana, Maine, Michigan, Minnesota, Mississippi, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Puerto Rico, South Dakota, Tennessee, Vermont, West Virginia and Wisconsin ("Class Jurisdictions").

Settlement of these lawsuits could affect you if you indirectly purchased products containing MSG or Nucleotides manufactured or sold by Archer Daniels Midland Company; Ajinomoto Co., Inc. and Ajinomoto USA, Inc.; CJ Corp., f/k/a Cheil Jedang Corporation and CJ America, Inc.; Daesang Corporation, Daesang Group d/b/a/ Miwon Group, Miwon Company Ltd., Daesang Japan, Inc. and Daesang America, Inc.; Kyowa Hakko Kogyo Co., Ltd., Kyowa Hakko U.S.A., Inc., Kyowa Foods, Inc., and Kyowa America, Inc.; Samsung Corporation; and Takeda Pharmaceutical Co. Limited f/k/a Takeda Chemical Industries Ltd. (collectively re-

ferred to as "Settling Defendants") and their affiliates.

### What Are the Terms of the Settlement?

The Settling Defendants have agreed to establish a fund (the "Settlement Fund") to resolve this litigation. Plaintiffs will recommend the Settlement Fund, minus various costs (including attorneys' fees, the costs of notice and settlement administration), be distributed *cy pres* to various charitable organizations within the Class Jurisdictions or as otherwise directed by the Court. Plaintiffs' counsel will request attorneys' fees not to exceed 33.33% of the Settlement Fund plus reimbursement of expenses.

Plaintiffs propose that the approximate distribution of the Settlement Fund (before costs) be allocated to each of the participating states as follows: Arizona-\$1,813,740; Arkansas-\$942,667; District of Columbia-\$202,852; Florida-\$5,648,050; Hawaii-\$429,570; Iowa-\$1,034,150; Kansas-\$950,622; Louisiana-\$1,579,067; Maine-\$449,457; Michigan-\$3,512,132; Minnesota-\$1,738,167; Mississippi-\$1,006,307; Nevada-\$707,995; New Jersey-\$2,975,170; New Mexico-\$644,355; New York-\$6,706,065; North Carolina-\$2,843,912; North Dakota-\$226,717; Puerto Rico-\$1,344,395; South Dakota-\$266,492; Tennessee-\$2,008,637; Vermont-\$214,785; West Virginia-\$640,377; Wisconsin-\$1,893,290.

### What Are Your Options?

If you do not want to be legally bound by the Settlement, you must exclude yourself in writing, postmarked by **September 15, 2006** and sent to MSG Indirect Purchaser Settlement Administrator, P.O. Box 832, Acworth, GA 30101-0832. Excluding yourself may allow you to bring your own claims against the Settling Defendants.

If you stay in the Settlement Class you will release claims related to the purchase of MSG and Nucleotides during the time period. You may object to or comment on any aspect of the Settlement. Your objection/comment must be written and postmarked by **September 15, 2006**. You may also request in writing to speak at the Final Approval Hearing. The detailed *Notice of Proposed Class Action Settlement* describes the procedures for excluding yourself from or objecting to the Settlement or requesting to speak at the Hearing and can be obtained as outlined below.

### Final Approval Hearing

The Court will hold a Final Approval Hearing on **October 25, 2006** at 9:00 a.m. MDT and will consider whether to approve the Settlement, award attorneys' fees, and allow reimbursement of expenses.

**For more information and a copy of the *Notice of Proposed Class Action Settlement*,**

**Call: 1-888-245-1009 Access: [www.msgindirectsettlement.com](http://www.msgindirectsettlement.com)**

**or Write: MSG Indirect Purchaser Settlement Administrator  
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Cesar Millan rehabilitates dogs —and trains their owners.



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packs. The shepherd no longer cowers under a desk. The mutt ends her quest to kill the neighborhood cats. It's a miracle, his clients say. No, says Millan: "It's energy. The language that I use is universal—calm, assertive energy. Dogs are pack animals. Humans need to establish the leadership role, and once they do, their dogs will follow."

While growing up on a farm in Mexico, Millan spent time observing dogs and other animals. At 13 he told his family that he intended to become the best dog trainer in the world. By the age of 21, he had moved to California, found a job at a dog grooming parlor, and bonded with a rottweiler named Psycho. Many dogs later, Millan just might be the most famous—some would say the best—dog trainer in the world. See him in action on *Dog Whisperer*, Friday nights at 9 p.m. ET/PT on the National Geographic Channel.

**NG Exhibits**

**One World, One Tribe**

From a Rwandan refugee's look of desperation to the joyful energy of a Turkish whirling dervish (below), photojournalist Reza has captured images of the world's struggles and triumphs. "The many paths that I have trod over the past 30 years enabled me to meet people whose unique destinies have deeply influenced me," Reza says. "I was close to each of them to the point that I could feel their suffering as well as their joy."

Last year the French government honored Reza with the French Order of National Merit for pictures that "contribute to our understanding of the world" as well as for the work of Aina, an organization he founded to help develop an independent press in Afghanistan. At that time, more than a million people came to see an exhibition of Reza's photos that hung in the Luxembourg Gardens, outside the French Senate in Paris.

Now his exhibition is in Washington, D.C. "One World, One Tribe," an outdoor display at the National Geographic Society through October 8, celebrates his work and his vision of the world. Says Reza, "This exhibition is the story of the human family—our family."





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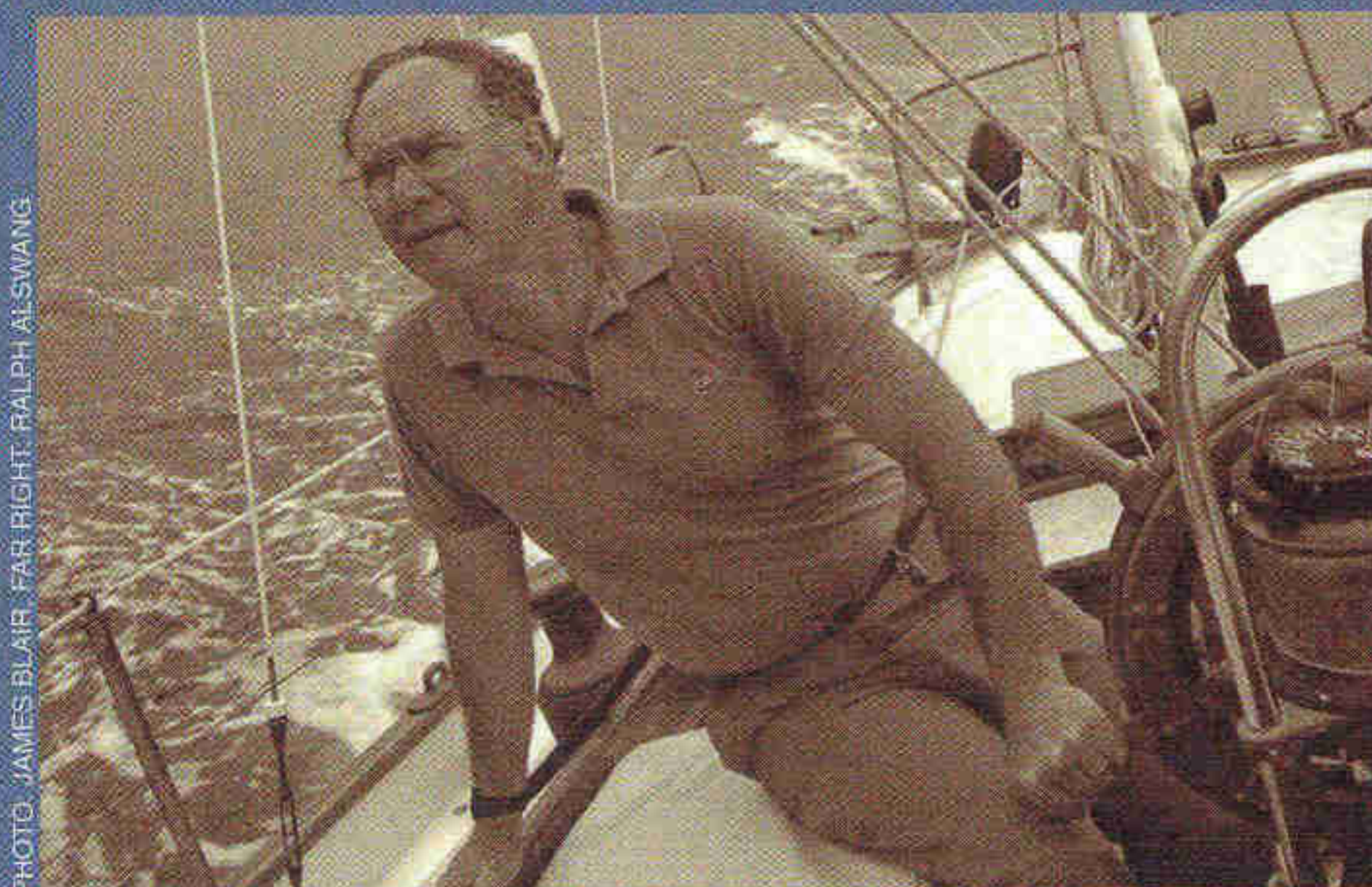


PHOTO: JAMES BLAIR, FAR RIGHT: RALPH ALSWANG



**GILBERT M. GROSVENOR**, chairman of the National Geographic Society, has dedicated himself to returning geography education to America's schools. On May 3, 2006, 1,000 friends helped Gil (pictured with his wife, Wiley) celebrate his 75th birthday while honoring his Geographic career and commitment to geography education.

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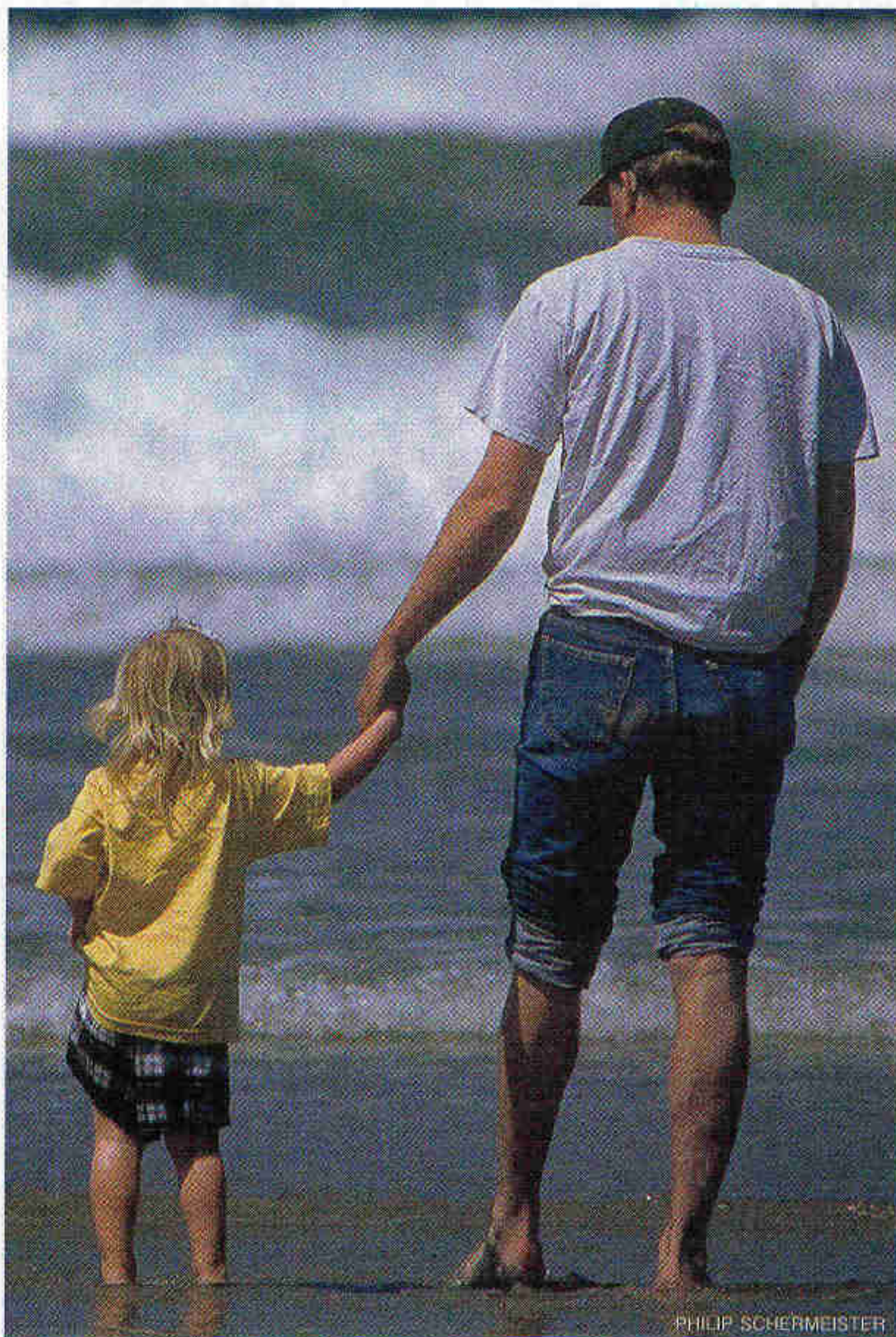
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For more information on Mr. Grosvenor's legacy, The Grosvenor Fund, or to see images from the May 3 celebration, please visit [www.nationalgeographic.com/grosvenorgala](http://www.nationalgeographic.com/grosvenorgala).





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**Flashback Archive** All the photos plus e-greetings, in Fun Stuff at [ngm.com/0608](http://ngm.com/0608).

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